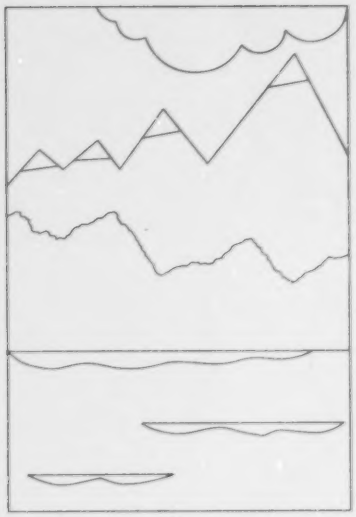

ANNUAL REPORT

1987
1988

Alberta
ENVIRONMENT

90-03892/

Alberta

ENVIRONMENT

Office of the Minister

130 Legislature Building, Edmonton, Alberta, Canada T5K 2B6 403/427-2391 Fax 403/422-6259

The Honourable David J. Carter
Speaker of the Legislative Assembly
Province of Alberta
325 Legislature Building
EDMONTON, AB

Sir:

I have the honour to present the eighteenth Annual Report of the Department of the Environment for the year ended March 31, 1988.

Respectfully submitted,

RALPH P. KLEIN
Minister

Alberta
ENVIRONMENT

Office of the Deputy Minister

14th Floor, Oxbridge Place, 9820 - 106 Street, Edmonton, Alberta, Canada T5K 2J6 403/427-6236

The Honourable Ralph P. Klein
Minister of Environment
130 Legislature Building
Edmonton, Alberta

Sir:

I have the honour to present the eighteenth Annual Report of Alberta Environment, for the fiscal year ending March 31, 1988.

Respectfully submitted,

Vance A. MacNichol, P. Eng.
DEPUTY MINISTER

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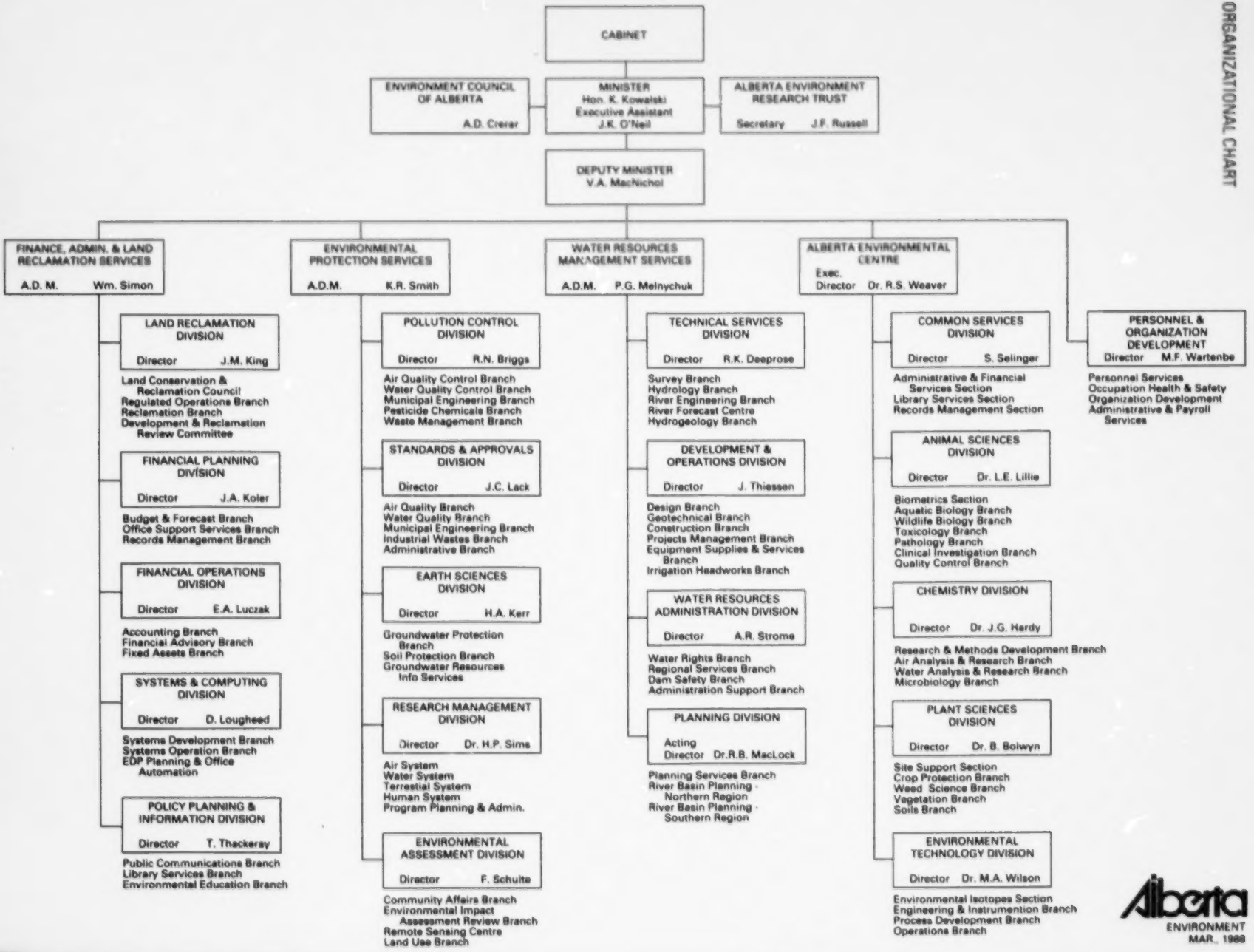


Alberta
ENVIRONMENT
MAR., 1988

EXECUTIVE SUMMARY

Alberta Environment began the 1987-88 fiscal year with a new mission statement, "to achieve the protection, improvement and wise use of Alberta's environment now and in the future". The new mission statement reflected a change from the challenge of balancing the needs of the economy and the environment to an emphasis on protection and improvement of the environment.

The department's redefinition of mission was responsible for a number of changes and new directions which emerged during the 1987-88 fiscal year and the department's organizational structure was adjusted to reflect the new directions.

A significant development was the appointment of a panel to undertake a comprehensive review of environmental law enforcement in Alberta. The panel's purpose was to strengthen the enforcement of the province's environmental statutes. Its representatives from government, industry and the public were asked to examine Alberta's approach to enforcing environmental legislation and prepare an action plan for making improvements. The panel completed its work and issued two reports, both of which were under careful review and consideration by the minister and senior departmental management at fiscal year end.

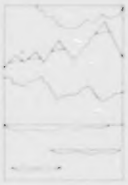
In keeping with its new mission statement, the department made several organizational adjustments designed to improve its overall efficiency and effectiveness. As of the end of the fiscal year, all of the functions of the Research Management Division were transferred to the Alberta Environmental Centre at Vegreville and the division was disbanded. The Environmental Assessment Division was transferred to Environmental Protection Services and Land Reclamation became part of Finance and Administration and Land Reclamation Services. In Water Resources Management Services, the divisions of Design and Construction and Operations and Maintenance were amalgamated into one division called Development and Operations.

The 1987-88 year saw the presentation of the first annual Alberta Environmental Awards during Environment Week. The awards represent a commitment to environmental excellence in individual, industry and education categories. Winners of the first Alberta Environment Awards were as follows: Dan Stoker, individual; Shell Canada, industry; and the S.E.E.D.S. Foundation, education.

OFFICE OF THE DEPUTY MINISTER

Vance A. MacNichol
Deputy Minister

Morgan Wartenbe
Director
Personnel and Organization
Development Division



PERSONNEL AND ORGANIZATION DEVELOPMENT DIVISION

The Personnel and Organization Development Division provides the human resource management services which enable the department to serve the public effectively, with a competent, safety-conscious work force. The division reports to the Deputy Minister.

The division has four branches: Administrative and Payroll Services; Personnel Services; Organization Development; and Occupational Health and Safety.

Administrative and Payroll Services Branch

This branch provides administrative services to the division and is also responsible for departmental payroll functions. As of March 31, 1988, the department had 1,120 salaried positions (Table 1), with more than one-half located in Edmonton and the remainder in field offices throughout the province (Table 2). Major field offices are located in Vegreville, Lethbridge, Calgary, Grande Prairie, Peace River and Red Deer. Distribution of employees within the department is reflected in Table 3.

During 1987-88, 47 salaried and 315 wage employees commenced work with the department, 126 salaried and 241 wage employees terminated their employment and five employees were transferred to other provincial government departments.

Personnel Services Branch

This branch provides comprehensive personnel services through a staff of personnel consultants and the division director.

Organizational changes and regular updating of position descriptions resulted in the classification of 111 positions. The staff has authority to make classification decisions on all positions with the exception of those in management. The branch conducted 80 recruitment transactions.

Staff assist employees and management in employee relations issues, career planning, organization development matters, grievances and complaint procedures. The administration of the Long Term Disability Income program and design and delivery of in-house training are also branch responsibilities.

Organizational Development Branch

This branch responds to initiatives from senior management and proposes initiatives to senior management in an effort to improve departmental performance in achieving its goals and objectives.

During the year, considerable research was conducted on the management of performance. The department's policy is being rewritten and will become an update to the department's Personnel Policies and Procedures Manual. A department Training and Development Calendar was prepared and circulated.

The branch coordinated the development of a division brochure, designed to clarify the role of the division and its branches.

Considerable work was carried out on the personnel planning aspect of the strategic plan and a presentation was made to executive committee. This project is continuing.

The branch administers the staff development function for the department and involvement in external courses increased over the previous year. Internal programs continued and the main one, entitled "Working", was offered in Edmonton, Vegreville, Peace River and Lethbridge. This program is instructed by line managers and is designed for front line staff. These instructors have been most conscientious and program evaluations from participants and their supervisors have been very positive. A variety of other general and specialized programs were delivered as needed.

The branch head retains responsibility for departmental appraisal systems and shares responsibility for the Women's Program with the Administrative Services head, Land Reclamation Divison, a line manager selected by the Deputy Minister.

Details of the women's program are set out in "Alberta Plan for Action for Women: A Proud History, A Bright Future". This document describes the Government of Alberta's commitment to improving the status of women to full and equal participation in all aspects of life in Alberta.

Assistance to the director and other personnel administrators on such areas as employee relations is provided on request.

Occupational Health and Safety Branch

This branch coordinates the department's occupational health, safety and hygiene programs, provides a professional consultation service to staff and is the main contact with the Worker's Compensation Board, Alberta Community and Occupational Health and the Occupational Health and Safety Branch of the Personnel Administration Office.

An emphasis on safety training and awareness programs continued, with special attention given to cost effective programs offered regionally to minimize travel costs. During the year, 47 in-house health and safety training programs were arranged for more than 1,000 participants.

Work in the area of health and safety included work site visits, environmental studies and implementation of the new medical surveillance program. Additional emphasis was placed on the department's responsibility as a principal contractor and worksite visits were extended to contract operations such as the Oldman River Dam.

ALBERTA ENVIRONMENTAL CENTRE

The Alberta Environmental Centre in Vegreville is the province's major facility for applied environmental research, technology development and related services. These activities are carried out at the request of provincial agencies and the public, after review and approval by the centre's Board of Directors and Technical Advisory Committee.

The Departments of Environment; Agriculture; Forestry, Lands and Wildlife; Community and Occupational Health; and the Alberta Research Council continue to be the centre's main clients. Alberta Technology, Research and Telecommunications took an active interest in finding commercial applications of new technology being developed at the centre. Twelve inventions/processes are currently being investigated.

While most research was conducted at the centre's 19,000 square metre main laboratory building in Vegreville, staff also travelled throughout the province to pursue information requested by client agencies. Studies ranged from the use of insects to control weeds to analysis of environmental pollutants to drinking water treatment. Specialists from fields as diverse as veterinary medicine, botany, chemistry, microbiology, engineering and library science were involved. Emphasis continued on attempts to develop a true interdisciplinary approach to individual scientific problems.

Demand for the centre's analytical and diagnostic services was heavy. More than 23,555 samples of water, air, soil and other materials were subjected to more than 305,000 tests to support provincial programs in health, pollution abatement and control and fish and wildlife management. In addition, about 3,000 specimens of weeds, insects, plant diseases and chemically damaged plants were examined at the request of farmers, gardeners and agricultural personnel. The centre also handled identification of bacteria for non-medical purposes and provided a rapid toxicity testing service using bacteria.

Providing information to client agencies and the public continued to be a significant part of the centre's work. This year the centre published "Herbicide Carry-Over", a booklet to help farmers prevent or deal with herbicide residue problems in their soils and thereby reduce carry-over damage to the next crop in a rotation. A bioassay technique was developed to detect Lontrel* residues in soil.

* Indicates registered trademark

The applied research carried out by the centre can be broken down into six broad categories: pest management; water/wastewater; toxicology; living natural resources; waste management; and land resources. Support to clients was also provided in the areas of analytical, diagnostic, extension and technical services. All of the centre's work aims for practical answers to real problems faced by client departments and concerned Albertans.

Analytical, Diagnostic, Extension and Technical Services

The centre's greatest single activity is the provision of information on air and water quality and on results of wastewater, weed science and crop protection studies to the people of Alberta and other government departments and agencies. Services in this area ranged from providing routine chemical analysis of drinking water samples to agricultural pest identification services.

The centre is the main chemical analysis laboratory providing support to Alberta Environment's licensing, monitoring and enforcement programs. As part of a major air analysis services program, approximately 6,800 air samples were run through more than 18,000 tests.

They were analysed for sulphur gases, lead and other metals, nitrogen oxides, vinyl chloride, benzene and other toxic organics. Centre staff also worked to develop new and more effective tests for atmospheric pollutants. Some 200 precipitation samples were analysed for 2,000 parameters under the "Precipitation Studies" program. Under the federal government "Long Range Transport of Air Pollutants (LRTAP)" program, 30 precipitation samples were analyzed and very good comparability of results was achieved.

The department was also supplied with information used in monitoring municipal water supplies, waste treatment facilities, industrial waste discharges and surface water quality. The centre's facilities were used frequently by public health units throughout the province to test the quality of drinking water from wells and other private water supplies. About 13,000 water samples were received and analysed for inorganic cations and anions which constituted some 211,000 tests in support of these programs. In addition, water, effluents, soil, sediments and other biomaterials were analysed for

trace levels of other contaminants. A total of 1,136 samples were tested for PCBs (polychlorinated biphenyls), hydrocarbons and other significant pollutants, which constituted some 42,400 tests. Legal samples from various locations throughout Alberta were analysed for heavy metal and effluent parameters as well as trace organics and pesticides. All analytical results and legal sample analysis reports were provided to the Fish and Wildlife or the Pollution Control Division.

Identifying insect pests, weeds and plant diseases is another function of the centre. In 1987-88, 518 insects, 858 plant diseases and 506 weeds were identified. Approximately 1,200 specimens were processed in the investigation of 435 cases of suspected chemical damage to crops and other vegetation.

Approximately 563 samples were analysed for a total of 10,136 parameters in providing microbiological enumeration and identification services. As part of microbial toxicity testing services, 34 samples were assessed for toxicity involving 318 parameters. These services were supported by ongoing quality assurance/control activities.

The Environmental Isotopes Program provided tritium and radiocarbon analyses to seven government agencies. Through cooperative arrangements with the Geology Department at the University of Alberta, C-13 analyses have also been carried out for clients. The data has been used in studies on groundwater movement, wastewater management, geology and archaeology.

Electron microscope studies supported research into inhalation toxicology, plant diseases, waste management and many other fields. A total of 970 electron microscope investigations were conducted on material ranging from bacteria, viruses and fungal spores to animal and plant tissues and asbestos fibres.

To make certain of the accuracy of analyses performed at the centre, high priority was given to quality assurance and quality control. For example, the Water Analysis Laboratory completes approximately 32,000 quality control tests per year to assure the quality of data it produces.

Other services included the investigation of livestock toxicology, assistance in the capture of big game animals and the development of methods for detection and analysis of a variety of environmentally-significant chemicals.

Pest Management Research and Development

Since the centre doubles as Alberta Agriculture's Regional Crops Laboratory for the northeast and north central areas of the province, finding effective, practical, and environmentally sound methods for the control of weeds, plant diseases and insect pests of crops and livestock is the object of research by centre staff. Many of the studies were also aimed at eliminating or reducing the use of chemical pesticides.

Research continued on the economic impact of crop losses due to weeds and on the economics of chemical weed control. The information was in demand during this year particularly, due to low grain and oilseed prices. A straightfoward computer program was developed and made available to assist producers in estimating the cost-benefit of wild oat control with herbicides. Information on canola yield losses due to volunteer cereals and quackgrass was also developed and passed on to producers via the farm press. A weed survey of the Peace River region identified the most abundant weeds. These included field horsetail in cereals and canola and stinkweed in canola, all of which are very difficult to control.

Greenhouse studies were conducted to confirm significant loss in activity of Fusilade*, Excel* and Hoe-grass* on wild oats growing under drought conditions and to examine various factors which influence the efficiency of activated-charcoal in neutralizing residues of soil sterilants such as Hyvar*. Other projects undertaken at the centre include studies to evaluate tolerance of new varieties of wheat and barley to herbicides and to evaluate the effects of carry-over of herbicides such as Glean*, Ally* and Amber* on rotational crops.

Several pathogens were isolated from diseased weeds and tested for their potential as biocontrol agents. Also, an experimental bioherbicide was field tested to evaluate its activity on round-leaved mallow under local conditions. Research continued with a defoliating moth and a root-boring moth to determine their potential as biocontrol agents against toadflax.

More releases of leafy spurge flea beetle species were made in the province and monitoring of previous release sites is an ongoing activity. Observations continued on the establishment of the perennial sow-thistle gall-midge and the Canada thistle seed-head weevil released at the Alberta Environmental Centre in 1984 and 1986, respectively.

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* Indicates registered trademark

Combining chemical controls of several important diseases in individual field crops was the main objective of a research project on plant diseases. On canola, the effectiveness of seed treatment fungicides to control seedling blight at different depth of seeding and to control virulent blackleg was studied. Field surveys showed virulent blackleg continued to spread in northeastern Alberta. To determine which other crops and plants were helping in the overwintering and spread of the blackleg fungus, its infectivity was determined on common cruciferous vegetables and weeds. Experiments were carried out to determine variability, and identify different strains of the blackleg fungus. The information will help plant breeders to develop blackleg-resistant lines of canola. Field tests were completed on fungicidal control of root rot and foliar diseases in cereals and on sclerotinia stem rot of peas and lentils. Several breeder lines of cereals were screened for resistance to foliar diseases.

With the objective of increasing productivity and stand longevity of alfalfa crops, investigations continued into the causes and control of alfalfa decline and other destructive diseases of alfalfa. Experiments were completed on the effect of crown and root rot on alfalfa growth, the screening of alfalfa cultivars for resistance to foliar diseases and to crown and root rot and the use of fungicidal seed treatment to control Pythium root rot of alfalfa. Research continued on the influence of cutting practices on development of snow mould in alfalfa and on the survival of snow mould in infected stems of alfalfa buried in the soil. A beneficial root-infecting fungal complex called mycorrhizae is an important component of intensively managed alfalfa. It not only increases plant growth but also protects roots from certain disease-causing fungi. Studies were undertaken into the influence of mycorrhizae on fungal wilts of alfalfa and the effect of herbicides on mycorrhizal development in alfalfa.

Research projects on insect pests involved field and greenhouse studies on the control and impact of insects on livestock, field and greenhouse crops. A three-year research project to develop methods of protecting cattle against blackflies was completed. The data collected was submitted to support registration of an insecticide application method for use by cattle producers. Preliminary studies on the tolerance of various barley varieties to barley thrips revealed significant differences among varieties, based on yields. Research continued on combined chemical and biological control of western flower thrips in greenhouse cucumbers. On behalf of Alberta Agriculture, a Regional Crops Variety Trial was coordinated in northeastern Alberta involving assessment of productivity of new varieties of cereals and canola at four sites. Field monitoring of black-flies and of various cutworm moths was conducted to alert livestock and crop producers to potential pest outbreaks.

Staff also analysed pesticide residues in water, soil, vegetation and sediments as a service to clients including Alberta Environment and public health units throughout the province, as well as in support of centre activities. A total of 1,008 samples were tested for pesticides, which constituted some 21,500 tests. Research reports on swine mange, pesticide residues in cattle and control of insects in vegetable crops were completed.

Water/Wastewater Management Research and Development

A study of the effects of nitrogenous waste products of coal mine operations in combination with industrial flocculants was completed. Preliminary surveys began on the effect of effluents of two new pulp mills. Plans for a more extensive study of the effects of pulp mill effluent on water quality and aquatic life were developed.

Extensive developmental work continued on the use of several invertebrate species for use in aquatic toxicology. The assay systems currently available at the centre are among the most comprehensive in North America.

From water and wastewater treatment to the effects of contaminants on aquatic systems, centre staff looked into a wide range of water-related problems.

The centre's mobile water treatment research plant was used to evaluate drinking water treatment technology. Particular emphasis was placed on ways to inactivate (render harmless) or remove the organism which causes "beaver fever" or giardiasis, a project carried out in cooperation with the University of Calgary. A second, smaller water treatment pilot plant utilizing ozone technology has been commissioned for service in projects on disinfection and color, taste and odor control. Work also continued on a long term project to determine the distribution and concentration of environmentally significant chemicals (such as mercury) in Alberta's waters. To monitor mercury levels in fish, more than 700 fish tissues from 31 lakes and rivers were analysed. In addition, a report on an earlier study on mercury residues in fish from 24 Alberta lakes and rivers was completed and a manuscript on the geochemistry of mercury is being prepared.

Determining the effects of wastewaters on natural water systems and the life they support was the object of a number of aquatic toxicology studies. Reports generated as a result of these studies included those on the chemistry and toxicity of alum sludge, coal mine wastewater and kraft pulp and paper mill effluent. A number of new laboratory techniques were developed to study changes in fish exposed to effluents.

Environmental Toxicology

Work continued on a long-term program of applied research in inhalation toxicology - the effects of inhaled gases, vapors and particulates. This program was generated by wide-spread concern for the possible health effects of sour natural gas. Research work to date has concentrated on the effects of hydrogen sulphide, the major contaminant of sour gas.

A new 360 m^2 containment inhalation toxicology laboratory was commissioned after a full year of testing to ensure that experimental studies of highly toxic substances in the atmosphere could be carried out safely and competently. The centre is now one of only three laboratories in Canada capable of industrial scale inhalation toxicology research. Work was completed on a series of 18 separate studies to define and clarify the acute effects of hydrogen sulphide in laboratory animals. These studies ranged in concentrations from as low as 1.4 mg m^{-3} (milligrams per cubic metre of air; equivalent to one ppm) up to 2100 mg m^{-3} (1500 ppm). Acute effects of hydrogen sulphide have now been characterized and, where necessary, previously known information confirmed or clarified. Studies on the detection of hydrogen sulphide ion in brain tissue and the development of acute pulmonary edema (flooding of the lung) were undertaken in cooperation with the Universities of Alberta and Calgary. Reports of completed work were published in several international scientific journals and at scientific meetings.

In cooperation with the universities in western Canada a five-day lecture and laboratory course in inhalation toxicology was provided to 22 individuals, primarily graduate students in toxicology.

Plans were completed to continue work on: mechanisms of action of hydrogen sulphide in laboratory animals; development of facilities to study the effects of exposure of domestic (farm) animals to hydrogen sulphide; longer term studies at lower (environmental) concentrations; and an assessment of the possible effects of hydrogen sulphide on reproduction.

The Water Analysis Laboratory has developed a rapid, sensitive method to determine the concentration of H_2S in environmental waters and biological tissues. Analysis of brain tissue has been completed to confirm the presence of elevated levels of H_2S in suspected cases of H_2S fatalities.

At the request of Alberta Agriculture and the Irrigation Council of Alberta, studies were initiated on the suitability of triploid grass carp (*Ctenopharyngodon idella*, Val.) as a potential non-chemical alternative for aquatic herbicides used to control vegetation in irrigation canals in southern Alberta. Studies of the biology and viability of this species of grazing fish under Alberta conditions will be conducted. Methods will be developed for verifying the triploid genetic status of these fish in order to ensure that they are unable to reproduce. This work represents the first attempt to introduce grass carp into Canada as a biological control agent for aquatic weeds.

At the request of Alberta Technology Research and Telecommunications and in cooperation with the Alberta Research Council and a private company engaged in the development of biological control agents, procedures were established for conducting studies required by Canadian regulatory agencies prior to the approval of products as commercial pest control agents. Initial work began on a biological herbicide potentially suitable for the non-chemical control of selected weeds in western Canada.

At the request of Alberta Agriculture, a major new research program was begun on the effects of crude oil and drilling materials on livestock. The request arose from incidents of pasture contamination by drilling activities and the program initially focuses on the effects on range cattle. Acute toxic effects, methods of treatment and/or salvage, residues in meat and, in particular, chronic effects on growth and reproduction are of concern.

During the year three studies were conducted on the effects of exposure of range cattle to a typical light sweet Alberta crude oil. The laboratory and data analysis phase of this work is continuing and a request to assess the effects of other oilfield chemicals is under review. Work was also undertaken to prepare facilities for long-term housing of cattle so that studies can be carried out over several calving cycles. Analytical facilities and methods were developed to detect hydrocarbon residues in tissues.

Living Natural Resources

Field work, laboratory analyses, and report preparation were carried out on a series of studies related to the effects of physical and chemical changes in the environment on the stability and productivity of fish and wildlife populations and on the conflicts between agriculture and wildlife.

Field work was completed on a study of the Dickson Dam/Gleniffer Lake project in central Alberta. The study assessed the effects of a new dam and reservoir on the species diversity, populations, reproductive performance and methyl mercury accumulation of fish upstream of the dam.

Analyses were completed and several reports submitted to scientific journals on baseline data of bear populations in the Berland-Little Smoky River forestry management area prior to the forest harvest. The current provincial grizzly bear management program was reviewed and recommendations made to Alberta Forestry, Lands and Wildlife. Ancillary studies on the use of Landsat data to determine habitat types were completed, several reports were published and further reports are underway.

A study of the use of selected plant species for reclamation and the attractive or aversive properties of these species for native ungulates was completed in cooperation with the Plant Sciences Division and the University of Alberta.

Work continued on control methods for pocket gopher depredation of forage crops and coyote depredation of sheep flocks.

In cooperation with the Fur Institute of Canada, intensive work continued on a program to develop and evaluate more humane trapping devices for harvesting wild furbearing animals. A rigorous, multi-stage assessment procedure was developed to assess candidate devices and to verify whether or not such devices met criteria established by the Canadian General Standards Board. One device developed at the Centre was determined to have met all requirements. Reports of this work have been submitted for external scientific peer review prior to publication in scientific journals and release to the general public.

Waste Management Research and Development

Reducing environmental waste problems while exploiting the economic potential of wastes are the compatible goals of the centre's studies which use physical, chemical and biological processes to provide waste management data.

A pilot-scale incinerator was installed in the new incineration research building. Staff plan to use the facility to examine incineration as a safe method of both using and disposing of wastes. A project on using sulfur hexafluoride (SF_6) as an incineration surrogate was completed.

In cooperation with Environment Canada, the U.S. Environmental Protection Agency and private industry, centre staff continued research work on solidifying and stabilizing waste. The objective of the work was to assess the suitability of selected processes for waste management in Alberta. Emphasis was placed on determining the value of commercial stabilization and fixation processes in Alberta's severe climate. Another study focused on chitosan, a naturally-produced polymer which may be used in waste management applications such as flocculation and heavy metal absorption. A patent was applied for on a novel chitosan production process.

Studies on the use of microbiological processes in waste management continued. Experimental work included the development of an enzyme assay for rapid detection of herbicide residues in soil and chromium removal from liquid wastes using Rotating Biodisc Contactors. The draft report of an interdisciplinary and interdepartmental project studying the impact of cattle feedlot wastes on the quality of receiving surface waters in Alberta was completed.

In cooperation with an exchange scientist from Harbin, China, a study was carried out to determine if local waste materials can be used to grow exotic mushrooms on a commercial scale. Straw, sawdust and aspen wood are some of the potential growth media examined. The program is of special interest to Alberta Agriculture's Special Crops Branch. A technology transfer workshop was held at the centre and was well attended by scientists, growers and those exploring new opportunities for crop diversification.

Land Resources Management Research and Development

Finding ways to restore lands disturbed by unusual activity (e.g., strip mining) was a major goal of the centre. Studies focused on developing and testing ways to accelerate reclamation, lower its cost and ensure the reclaimed land is restored to its original productivity. One program is aimed at selecting, developing, testing and licensing native plant species for use in reclaiming disturbed lands. The Native Species for Reclamation Program intends to develop, register and make available plant material for use in the rehabilitation of disturbed lands in high-stress or sensitive environments where standard agronomic varieties would not be suitable. By the summer of 1987, 15 lines of alpine bluegrass and 10 lines of wheatgrass had been selected as having potential in reclaiming disturbances in the Eastern Slopes of the Rocky Mountains. As a next step these lines were evaluated for their reclamation potential in harsh eastern slope environments and for their seed production and agronomic characteristics on the plains. A second project involved the requirements for seed germination in Saskatoon berries and other shrubs which have potential usefulness in reclamation. Results from the investigation of the Saskatoon berry will also aid commercial growers of this fruit crop.

Greenhouse experiments were conducted to examine methods of amending soils to render them more resistant to soil compaction. Results suggest that resistance cannot be increased enough to substantially reduce compaction when heavy equipment is involved. A survey of soil compaction was undertaken on oil and gas leases in east-central Alberta to identify the extent and magnitude of soil compaction and what methods of measuring compaction are most suitable in the field. Results indicated that compaction is a problem on some wellsites. A large field experiment was designed to indicate the effect of soil compaction on crop productivity at compaction levels comparable to those occurring on wellsites and work commenced on one of two proposed sites. This

experiment will make use of, and add to, previous laboratory and greenhouse studies on the effect of soil compaction on plant growth and productivity.

The production of large amounts of oilsand sludge during tar sand extraction in the northeastern part of the province has led to a program aimed at dewatering sludges. The oilsand sludge, a gel-like suspension with only 30 percent solids, consolidates at such an extremely slow rate that the reclamation of the material cannot be done until a stable surface is established. Using the techniques of slope stability, freeze-thaw mechanisms and plant water uptake, large cells containing sludges of various solid contents are now being dewatered in Mildred Lake.

The movement of soluble salts, from sodic mine spoil to capped topsoil in coal mining reclamation, affects the quality of the topsoil. A field experiment, consisting of lysimeters fully equipped with meteorological equipment and filled with mine spoil and soil, was installed at the Alberta Environmental Centre, to monitor plant water use and the movement of salts from spoil to soil.

Technical Support

A total of 32 regulatory bioassays of industrial wastewater were conducted in support of the Alberta Clean Water Act. Staff also responded to 14 requests for technical assistance in support of potential litigation under the Act. These requests involved laboratory support, participation in field investigations and expert witness testimony.

Technical and administrative support for the operation of diverse applied animal-based research programs continued to be provided. The Animal Resources Program and the operation of the centre's Animal Care and Use Committee ensured that all work complied with the guidelines of the Canadian Council on Animal Care.

Essential services in clinical anatomical and ultrastructural pathology, biochemistry and analytical toxicology were provided by the Pathology and Clinical Investigation Branches. Professional statistical and administrative support services assisted all programs.

This program area encompasses the broad range of technical services required to support the centre's scientific and technological development activities. This includes management and development of the centre's 300-hectare Vegreville site. Crop research plots were developed and maintained, plot equipment was repaired and designed and the site was upgraded through activities such as fencing of elk pastures and hay field seeding. A large fleet of equipment and vehicles was maintained, including specialized experimental plot machinery.

A centre waste management program continued. It included operation of an interim wastewater treatment plant and systems for managing pesticides and concentrated laboratory wastes. Nearly 9,000 tonnes of laboratory wastewater and four tonnes of concentrated chemical wastes were treated and disposed of during the year. As well, three specialized water treatment systems were operated - a recycling plant supplies water to fish tanks, a reverse osmosis unit and an ion exchange unit provide water for laboratory use.

Major efforts were directed toward development of centralized computing facilities to collect and process data generated by centre laboratories. Special emphasis was placed on the customization and enhancement of software for the mainframe computer.

An instrumentation and controls program involved repair and maintenance of instruments as well as design and development of equipment and systems for monitoring and data collection purposes. Thirty-six controlled environment growth chambers and four seed germinators were operated at capacity, providing year-round growing conditions for plant-related studies.

Most capital facilities development projects during the year, including all laboratory and site developments, were suspended in September of 1986 to comply with provincial budget restrictions. However, greenhouse construction was begun. The provincial Fish and Wildlife Division and Ducks Unlimited were assisted in reclaiming wetlands on the site for water storage and waterfowl production. Installation of equipment in the incineration research building continued.

Administrative Support

Administrative support to centre programs was provided through the Common Services Division and smaller administration units attached to each of the four other divisions. Of the centre's 1987-88 budget of $10.4 million, $110,000 was unspent at the fiscal year end.

Library, financial, communications, personnel and related functions were performed by the Common Services Division. The library supplied information to staff through reference searches, collection development, inter-library loans and similar services.

Administration and control of the Centre's $10.4 million budget involved operation of an accounts section, a central stores facility and a central duplicating facility.

The communications section conducted tours for more than 500 people and produced an annual review. The information display was completed and a promotional video on the centre was planned and contracted.

Personnel services staff were active in training, payroll, classification and other staff relations duties. An active occupational health and safety program was maintained and an emergency response team was active.

Administrative units attached to the technical divisions functioned in a variety of support duties such as providing experimental design and data analysis, distributing chemical analysis reports and planning related to construction of facilities such as the incineration research building and the new greenhouse.

FINANCE, ADMINISTRATION, AND LAND RECLAMATION SERVICES

Wm. Simon, CMA
Assistant Deputy Minister

J.M. King
Director
Land Reclamation Division

J.A. Kolar
Director
Financial Planning Division

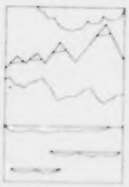
E.A. Luczak
Director
Financial Operations Division

D. Lougheed
Director
Systems and Computing Division

T. Thackeray
Director
Policy Planning and Information Division

Finance, Administration, and Land Reclamation Services provides administrative and support services to the department in the areas of financial planning, finanical operations, systems and computing, policy planning and information services. During the year the Assistant Deputy Minister was assigned responsibility for the Land Reclamation Division and for its related interdepartmental functions.

The Assistant Deputy Minister of Finance, Administration, and Land Reclamation Services is a member of the executive committee, is the senior financial officer of the department and is responsible for administering the Financial Administration Act. This involves establishment of a system of efficient internal controls, developing a code of accounts to satisfy both central agency and departmental requirements, satisfying financial reporting needs of department personnel and advising expenditure officers on expenditures monitoring and control.



LAND RECLAMATION DIVISION

The division administers The Land Surface Conservation and Reclamation Act and regulations.

The division reviews applications and impact assessments of proposed developments which disturb land and grants conditional approvals which set land reclamation standards.

Staff carry out inspections, reclamation projects and special studies to enforce and improve reclamation and environmental planning.

The division also administers the Surface Reclamation fund which comprises security deposits paid by developers to encourage satisfactory reclamation of disturbed land.

In January 1988, the division became part of Finance, Administration and Land Reclamation Services.

Land Conservation and Reclamation Council

The council is responsible for ensuring that construction, operation and abandonment of well sites, access roads, pipelines, transmission lines, sand and gravel, coal and oil sands operations are performed in such a manner as to return the land to the equivalent capability that existed prior to disturbance. There are 21 provincial and 163 municipal government reclamation officers within the council.

During 1987-88, reclamation officers monitored the operation of 639 development and reclamation approvals and nine exploration approvals and issued 68 Reclamation Orders and 1,567 Reclamation Certificates on abandoned surface disturbances.

Development and Reclamation Review Committee

The Development and Reclamation Review Committee is an inter-departmental committee established under the Land Surface Conservation and Reclamation Act to carry out detailed technical review of major coal and oil sands development applications. The committee recommends operational terms and conditions for development and reclamation approvals issued by the Minister.

The chairman of the Development and Reclamation Review Committee served as a member of the Syncrude Expansion Review Group (SERG) established by the Energy Resources Conservation board to facilitate discussion of concerns resulting from Syncrude Canada Ltd.'s proposed expansion. In addition to the ERCB, Syncrude and the department, the Fort McKay Indian Band and Forestry, Lands and Wildlife participated in the SERG process.

As a result of the SERG process, Syncrude agreed to provide their Development and Reclamation Application to the Fort McKay Indian Band for review and an invitation was extended to the band to present their views and concerns at committee meetings when Syncrude's application was being discussed.

The year 1987-88 saw development and reclamation approvals issued to four new in situ oil sands operations: Husky Oil Operations Ltd., Fisher Creek Multicycle Steam Stimulation Scheme; Mobil Oil Canada Ltd., Iron River Pilot Project; Pan Canadian Petroleum Ltd., Elk Point Oil Sands Project; and Petro-Canada Resources, PCEJ Hangingstone Experimental In Situ Recovery Scheme.

Ongoing expansion and changes in both coal and oil sands development necessitated the committee's review of a large number of amendment applications during the year. A total of 37 amendments were issued to existing development and reclamation approvals, 16 to coal mining, one to oil sands mining and 20 to oil sands in situ developments.

Crown Mineral Disposition Review Committee

The Crown Mineral Disposition Review Committee reviews requests for mineral sales to ensure that serious environmental effects are avoided. In certain cases, lands are requested to be withdrawn from sales. The committee reviewed 62 schedules relating to coal, oil sands and quarriable minerals. Oil and gas leases and licences constituted most of the work load.

Exploration Review Committee

This committee reviews coal exploration applications on behalf of the Land Conservation and Reclamation Council. During 1987-88, the committee reviewed and recommended seven applications for approval.

Regulated Operations Branch

The branch reviews development and reclamation approval applications for major pipelines, high voltage electric transmission lines and gravel operations. An interdepartmental review of these applications is also coordinated by the branch. After the review, approval conditions are recommended to the chairman of the Land Conservation and Reclamation Council.

Since the Sand, Gravel, Clay and Marl Surface Operations Regulation was enacted in 1982, a major function of the branch has been to notify pit operators of the regulation and help them to obtain required approvals.

Linear Projects Section: This section is responsible for the department's review and approvals process for high voltage electric transmission lines and oil and gas pipelines as referred by the ERCB. Section staff represented the Crown at nine ERCB pipeline and transmission line hearings. The section also coordinates a review of water and sewer pipeline projects and environmental impact assessments for major industrial developments.

The section reviewed ERCB applications and evidence presented at hearings on matters of environmental protection. Recommendations for ministerial approval and development and reclamation approval were prepared.

The section is completing a number of pipeline studies which are under review by industry and groups representing land owners.

Transmission Lines: The section reviewed 24 applications for electric transmission lines, an increase of five from last year. The section also reviewed 14 sewer and water projects and 11 environmental impact assessments.

Pipelines: The section reviewed 288 applications for pipeline projects in the province, an increase of 55 from the previous year. Of these, 28 applications required development and reclamation approval under the Regulated Oil and Gas Pipeline Surface Operation Regulations. This represented an increase of nine from last year.

Sand and Gravel Section: The Sand, Gravel, Clay and Marl Surface Operations Regulation A.R. 228/82 was enacted in 1982. Under this regulation, all large sand, gravel and clay operations on patented land in the province require a development and reclamation approval.

An inventory and notification program to record all operations and to notify the landowners and holders of a gravel lease of the regulation requirements was continued during the year. The program will continue until all operations on patented land have been recorded and all active operations have received development and reclamation approval.

In 1987-88, the program focussed on four municipalities which contained 221 gravel operations, of which 34 required development and reclamation approval. To April 1, 1988, 2,228 pit operations have been recorded in 40 municipalities with 675 requiring approval. The remaining operations were either inactive or were of a minor size which did not require approval.

During the reporting period, 107 applications for development and reclamation approval were reviewed. Some 89 approvals were issued to private developers, counties, Alberta Transportation and Alberta Environment operations. The sand and gravel referral system reviewed 81 proposed highway projects submitted by Alberta Transportation.

Reclamation Branch

The Reclamation Branch is involved with the actual reclamation of derelict lands and the administration of the Alberta Heritage Savings Trust Fund Land Reclamation Program.

Funding was provided to reclaim 96 derelict sites to some type of beneficial use. Of these, 84 projects were on municipal lands and 12 on Crown land (Table 18). The majority of the branch's reclamation projects are abandoned garbage dumps/landfills, sewage lagoons and gravel/sand pits located on municipal land.

FINANCIAL PLANNING DIVISION

The Financial Planning Division coordinates the department's budgetary process, records management, mail, courier, furniture, maintenance and duplicating services.

Budget and Forecast Branch

The branch monitored the 1987-88 departmental general revenue and Alberta Heritage Savings and Trust Fund expenditures and coordinated several government employment programs, as well as managing departmental space needs and insurance matters.

The branch also compiled the 1988-89 Alberta Heritage Savings and Trust Fund departmental budget of $43,560,000, the 1988-89 General Revenue budget of $85,331,000 and the Capital Fund Budget for Construction of Water Development Projects of $66,300,000. The branch also coordinates the Public Works, Supply and Services budget submission for capital construction and accommodation.

Office Support Services Branch

Among services provided by this branch are central duplicating, courier and mail systems, building maintenance and security, telecommunications and furniture, photocopying, microfilming, facsimile, diazo and other related areas.

Services are provided through a central office in Edmonton and regional offices in Lethbridge, Red Deer, Grande Prairie, Peace River and Calgary.

Records Management Branch

The branch coordinates and develops the records management program as legislated under the Public Works, Supply and Services Act. Significant advances were made in the management of both active and semi-active records.

Semi-active files continued to be managed through the disposition process. Some 323 cubic feet of records were transferred to central semi-active storage and 704 cubic feet were transferred off-site or destroyed, for a departmental saving of $155,308.

FINANCIAL OPERATIONS DIVISION

The Financial Operations Division provides centralized financial services to the department. This includes the development and implementation of internal and external accounting and financial policies and procedures required to ensure compliance with established government and departmental financial and administrative control systems. Division staff act as advisors, providing support to the department in the areas of expenditure and revenue accounting, fixed asset control, financial systems development, financial consultancy and internal systems review services.

The Division comprises three branches: Accounting, Financial Advisory and Fixed Assets.

Accounting Branch

The branch develops, implements and maintains departmental accounting and financial reporting systems to ensure operational procedures are in accordance with the Financial Administration Act and other government policies and procedures. Responsibilities include payment of all vendor accounts, recording and reporting of department liabilities, revenues and expenses and collection of outstanding accounts receivable. During the fiscal year the branch implemented remote data entry of transactions on the new departmental financial system (DFS).

Financial Advisory Branch

The branch conducts internal reviews of divisional financial and administrative systems and provides advice to ensure compliance with central agency requirements. The branch also reviews and approves all contracts, grants and agreements ensuring that they clearly express the department's intentions and that they comply with legal and financial requirements established by legislation. During the fiscal year, the branch assumed responsibility for development and maintenance of the department's Administrative Policies and Procedures Manual.

Fixed Assets Branch

The branch is responsible for the development and implementation of policies, procedures and systems to ensure adequate control and efficient management of departmental fixed assets. A program of cyclical physical verification of the department's fixed assets was initiated. The branch is also responsible for providing financial consultation to the Land Conservation and Reclamation Council, maintaining financial records and preparing the annual financial statement of the Surface Reclamation Trust Fund.

SYSTEMS AND COMPUTING DIVISION

The Systems and Computing Division supports all departmental programs in the planning, development, operation and maintenance of computer programs and systems. The division also provides computing facilities and trains departmental staff to use computer equipment and programs.

EDP Planning and Office Automation Branch

The branch develops computer systems and departmental electronic data processing plans. The branch conducts feasibility studies on computer systems and develops and implements word processing, electronic mail and electronic filing systems.

Systems Development Branch

The branch manages projects involving the development and enhancement of large and medium scale computer systems. The branch is involved in developing detailed system requirements, designing the system, as well as programming and implementation. The branch provides technical support and advice on telecommunications, data base and electronics.

Systems Operations Branch

The branch keeps operational systems up-to-date and operating reliably and efficiently. The branch also develops smaller systems, enhances and maintains all general-use equipment and provides an operational problems consulting service for staff.

Current Systems

More than 20 data systems and 40 scientific computer programs are maintained. The systems contain air quality, water quality, hydrometric, climatological and groundwater data used in the department's monitoring, assessment and regulatory activities.

Technical/engineering computer programs are used to delineate river floodplains, forecast river flows and predict pollutant concentrations.

Computer programs are used by technical staff to analyze data and assemble reports. Word processing and spreadsheet programs are widely used to prepare administrative information and technical reports. Administrative systems, such as a contract registry, groundwater well and water resource administration system are also operated by the department.

Projects Completed

Improvements were made in the office automation area and technical data analysis areas and assistance was provided to the HELP program. Workstations were installed to improve word processing capabilities and to assist in report, document and licence preparation and administrative tasks.

Most changes and enhancements were made to departmental systems and common computer facilities to improve efficiency, further reduce operating and maintenance costs, and enhance the department's capabilities to process and store data.

Co-ordination and Planning

The department and Environment Canada continued an exchange of data and systems technology. These exchanges involved water quality, air-monitoring and hydrometric data. The department has access to Canada Land Inventory data, indexes of available satellite and air photo imagery, data about municipal water and wastewater treatment facilities as well as information about special wastes and pesticides.

POLICY PLANNING AND INFORMATION DIVISION

The Policy Planning and Information Division comprises three branches. Public Communications, Environmental Education and Library Services. These branches assist department staff with communications activities, the development and implementation of educational programs and research and information services.

Public Communications Branch

The branch coordinates all communications needs of the department, including development, design and distribution of materials, media relations and communications planning.

Four issues of the magazine *Environment Views* were published. They examined the environmental themes of current trends, environmental health, winter cities (in conjunction with the Edmonton Winter Cities Festival) and conservation. Total circulation of this free subscription magazine is approximately 14,000.

A number of activities were organized to mark Environment Week, including the first annual Alberta Environment Awards, displays at shopping malls, an open house at the Alberta Environmental Centre, media interviews and speaking engagements.

Environmental issues again attracted a great deal of media attention and more than 235 news releases were issued. The branch also responded to more than 3,600 media calls.

The communications director, two public affairs officers and a production assistant in the Edmonton office handled more than 318 orders for print materials, photography, advertising, displays, signage and audio-visual presentations. Approximately 2,670 requests for department publications were filled.

Environmental Education Branch

The branch develops educational materials and provides educational services to the public through schools, post-secondary educational institutions, youth groups and community organizations. In addition, the branch coordinated the department's Environment Week program. Liaison and coordination with several other organizations including the Joint Committee on Environmental Education, the Environmental Education Advisory Committee to the Environment Council of Alberta, the Friends of Environmental Education Society of Alberta, the Environment Week Association of Alberta, the Environmental and Outdoor Education Council and the Science Council (both of the Alberta Teachers' Association) continued.

Programs in development or implemented in 1987-88 include:

The Water Literacy Program: a comprehensive in-school education program funded by Water Resources Management Services for grades 4-12 was completed. The program deals with all facets of water in Alberta including sources, uses and management of supply and quality. The units will support the science curriculum in Alberta schools. Materials will be made available to teachers free-of-charge through a province-wide workshop program.

SNOOP on Water: Some 4,000 copies of this unit were purchased and distributed to more than 1,300 schools in the province for use by early childhood educators. The unit introduces young children to water, its use and some related concerns such as water safety and water pollution.

Water in Alberta: The Living Flow: Two half-hour videos on Alberta's water resources and some of the concerns and issues addressed in management of the resource were developed for Alberta Environment by the ACCESS Network. The videos will be made available to the public on the ACCESS Network and to schools through the department.

The Home We Share: This educational poster was developed for use in public education programs where children aged five to 13 are present or participating. The poster and accompanying activities introduce the child to the environment and its use by humans. Some 20,000 copies of the poster were printed.

Library Services Branch

Library Services Branch provides information resources to support departmental research, program and policy making needs. Private industry, other government agencies, environmental interest groups, members of the public and students at post-secondary educational institutions also make use of these resources. Services include: purchase of all books,

documents and periodicals; organization of materials for maximum retrievability and accessibility; and dissemination of information resources through current awareness, reference, computerized information retrieval and interlibrary loan activities.

In 1987/88, the branch completed several major projects. The automated circulation system, which ensures the prompt distribution of information resources, was implemented in June 1987. The public relations program which began in 1986, was completed. In the last two fiscal years, more than 600 departmental staff have attended information sessions on the library's services and resources. Another project completed in 1987/88 was a weeding project which saw more than 2,500 outdated books and reports removed from the library's shelves.

ENVIRONMENTAL PROTECTION SERVICES

K.R. Smith
Assistant Deputy Minister

R.N. Briggs
Director
Pollution Control Division

J.C. Lack, P.Eng.
Director
Standards and Approvals Division

H.A. Kerr
Director
Earth Sciences Division

Dr. H.P. Sims
Director
Research Management Division

F.J. Schulte
Director
Environmental Assessment Division

Environmental Protection Services works to ensure that Alberta Environment's mandate for the protection, improvement and wise use of our environment now and in the future is accomplished.

The service ensures thorough environmental evaluations be carried out prior to development of projects. A high priority is placed on preventing problems through planning. Stringent standards for environmental protection are required to ensure that the generation of contaminants and their release to the environment are minimized.

Another key part of the service is monitoring of the environment, principally air, water, soil, wastes and pesticides, to ensure standards are followed and that environmental quality is maintained. Where necessary, enforcement activities are carried out to ensure compliance with standards. Research activities focus on finding applied solutions for environmental problems.

The service administers grants to local authorities in developing regional waste management facilities and non-profit organizations in establishing recycling centres.

In September, 1987 a Task Force on Environmental Law Enforcement in Alberta was established. Two distinct approaches to enforcement have developed. One approach holds that to be effective, environmental laws must be strictly upheld in the courts. The other, encourages negotiation as a more flexible cooperative approach to obtaining compliance with environmental laws. To date, Alberta Environment's enforcement system is based on a negotiation approach; the court system is used only as a last resort.

The review panel released two reports, An Action Plan for Environmental Law Enforcement in Alberta, released in January, 1988.

POLLUTION CONTROL DIVISION

The division enforces the Clean Water Act, the Clean Air Act, the Agricultural Chemicals Act, the Litter Act, the Beverage Container Act and regulations.

Air Quality Control Branch

The branch seeks to achieve air quality within established standards through enforcement of the regulations under the Clean Air Act and the terms and conditions of clean air licences. Branch staff carry out general air monitoring, maintain an extensive air quality monitoring network and sample emissions from stationary sources. Industry is required to monitor its operations and the branch reviews and verifies the results.

During the reporting period, one Emission Control Order was issued and two companies were prosecuted for contravention of the Clean Air Act.

The number of complaints received and investigated by the branch in 1987/88 increased 28 percent from the previous year for a total of 1,324 (Table 4).

Industry Compliance Review: The branch received monthly and annual reports from major industries such as fertilizer, petroleum, gas processing, oil sands, heavy oil, pulp and paper, meat packing, thermal power, steel, rendering, chemicals, plastics, cement and wood products. These reports were checked for compliance with licence requirements and cases of noncompliance were investigated.

Air Pollution Source Monitoring: In 1987, 177 sampling tests were conducted on 42 stacks at 21 plants to assess the air contaminant emission rates from stationary sources and to check compliance with approved limits.

Source emission surveys conducted by industries were reviewed for compliance and acceptability of sampling technique. Branch staff witnessed some 45 source emission surveys done by industry or consultants.

Urban Air Quality Monitoring: The air monitoring network for Edmonton and Calgary consists of 67 total sulphation stations, 75 dustfall stations, three fluoride stations, six soiling index analysers, six high-volume samplers and nine comprehensive continuous airmonitoring stations. Each of the continuous stations had instrumentation to detect carbon monoxide, ozone, oxides of nitrogen, nitrogen dioxide, sulphur dioxide and total hydrocarbons.

The continuous stations are located in Edmonton (3), Calgary (3), Fort McMurray, Fort McKay and Fort Saskatchewan. An air quality index (IQUA) based on levels of the most significant air pollutants (nitrogen dioxide, carbon monoxide, ozone, sulphur dioxide and smoke) was released daily to the media and public in Edmonton and Calgary.

The monitoring network for smaller urban centres consists of one high-volume sampler, 32 total sulphation, 22 hydrogen sulphide, 45 total dustfall and two fluoride exposure cylinder stations. During the year a comprehensive monitoring survey was carried out in Fort Saskatchewan.

Rural Industrial Air Quality Monitoring: The branch operated four mobile laboratories in the Red Deer, Whitecourt, Calgary and Edmonton areas. The laboratories continuously monitor sulphur dioxide, hydrogen sulphide and wind speed and direction. Special air quality monitoring surveys were conducted in the Elk Point, Fort MacKay and Fort McMurray areas.

A network of 146 hydrogen sulphide, 151 total sulphation and four fluoride exposure cylinder stations were maintained near rural industrial operations.

Monthly precipitation samples were collected and analyzed at 11 locations: Suffield, Calgary, Red Deer, Edmonton, Whitecourt, Beaverlodge, Cold Lake, Kananaskis, Fort Vermillion, Fort McMurray and High Prairie as part of an assessment of acid deposition in Alberta.

Meteorology and Chemistry: A user's manual for Alberta Environment's five air quality dispersion models was printed and announcements were sent to more than 200 users. A paper on the newest model was presented to the local section meeting of the Air Pollution Control Association. A paper on urban and rural ozone concentrations was accepted for publication and one on the modelling tracer study in the Moose Mountain area was published.

A daily precipitation and air chemistry sampling station was started near High Prairie to complement a similar federal installation in southern Alberta.

The branch participated in the data quality assurance of the Acid Deposition Research Program (ADRP). Station performance audits were conducted for the three ADRP air monitoring stations twice in the year.

A total of 26 complaint-related air samples were collected by adsorption tubes, Tedlar bags or passive samplers for organic analysis at the Alberta Environmental Centre.

The branch's Doppler Acoustic Radar was loaned to Environment Canada to support weather forecasting for the Winter Olympics in Calgary. It was then moved to Scotford, along with other components from the old Ellerslie site, to set up a new air pollution meteorological station jointly operated with the Fort Saskatchewan Regional Industrial Association.

Water Quality Control Branch

The branch enforces the Clean Water Act and regulations dealing with industrial wastewater effluents in order to protect and preserve the quality of water in lakes, rivers and streams. Activities in 1987-88 included:

Surface Water Monitoring: The Peace and Athabasca Rivers were the focus of attention for the branch. Monitoring of the Athabasca and Peace rivers was intensified in order to obtain good baseline data. This information is vital in determining what impact proposed pulp mill development will have on river water quality. Additional work was initiated in the Athabasca delta region to gather data on concerns expressed by native people about oil sands activity.

Surveys of macrophyte (plant) growth in the Bow River were again carried out to measure changes in downstream of the city of Calgary sewage treatment effluents. Long term monitoring of Wabamun, Baptiste, Nakamun and Ethel lakes continued in 1987/88 with monthly samples taken at each lake.

Industrial Compliance: Industries licenced under the Clean Water Act were inspected and samples of effluent collected to determine compliance with the standards. During the inspections, the wastewater treatment facilities were examined to verify proper operation. Annual and monthly reports submitted to the Division were reviewed for compliance with licensing conditions.

A survey of dioxin from pulp mill operations was initiated in 1987. Various media including pulp mill sludge, effluent, river sediment and benthic organisms were examined for dioxins.

Spills: In 1987/88, 150 spills were reported and investigated most were cleaned up with the exception of those where ground water was affected. Solutions to spills affecting groundwater are usually of long term nature and resolution of some of these spills is ongoing.

Complaints: Some 415 complaints concerning water quality were received and investigated by the branch. All but four investigations were concluded.

Municipal Engineering Branch

The branch seeks to achieve water quality within established standards by its enforcement of the Clean Water Act and regulations which deal with municipal water and sewage systems. Other branch responsibilities include monitoring municipal water and sewage systems, investigating complaints, providing technical advice and training and education of municipal water and sewage operators.

Field Services Section: This section is responsible for monitoring, inspections and enforcement. These activities are undertaken through offices in Edmonton, Grande Prairie, Lethbridge, and Red Deer. Table 6 illustrates the section's activity for the year.

Sampling of municipal sewage effluent and water supplies was maintained at the level of available laboratory capacity. Basic monitoring for treated water, sewage discharges, bacteriological quality, fluoride addition and giardiasis "beaver fever" continued. In addition, a major monitoring study for the presence of lead in the Edmonton area was conducted; and staff monitored Elkwater sewage going into Ross Creek and its possible effect on local water supplies.

Many investigations were carried out as follow-up to problems and complaints. These included: continued monitoring of Field Lake and Lac La Biche sewage effluent; evaluation of sewage lift station ventilation; biological problems in Calgary drinking water; the possibility of PCBs in well water from older pumps; monitoring for trace heavy metals in tap water; continued development of iron sequestering as an alternate or replacement for iron removal; monitoring lagoon leakage problems at Cold Lake/Grand Centre and Hay Lakes; improved general safety practices; continued application of pilot plant techniques to solve plant operating problems; and participation in the investigation into the use of the artificial snowmaking compound Snowmax* for the 1988 Calgary Winter Olympics.

A growing activity of the section is ensuring that municipalities comply with their licences to operate. At year end, 276 facilities were required to submit monthly reports. At the same time, approximately 600 communities were required to carry out stricter bacteriological monitoring and 55 communities which fluoridate their water were required to monitor fluoridation. Other administrative activities included preparation of annual summary reports of facility inventory, water and sewage effluent quality, special surveys of drinking water, bacteriological quality and fluoridation.

Certification, Education and Training Section: The section is responsible for operator training and certification programs.

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* Indicates registered trademark

The object of the program is to provide upgrading training to municipal water and wastewater treatment plant operators.

A total of 14 short courses and seminars and two correspondence courses were given by branch staff. Registration for the short courses and seminars was 513 and for correspondence courses, 42. Participants represented 123 Alberta communities.

Manuals for operators of small and medium-sized facilities were made available to all personnel operating water and wastewater facilities. These manuals are intended to help operators to operate their facilities as well as prepare for certification exams.

Branch staff provided input to the Water and Wastewater Technician Program at Westerra Institute of Technology. Assistance was also given to other organizations concerned with operator training, such as the Western Canada Water and Wastewater Association.

Alberta is one of two provinces in Canada with a mandatory certification program for water and wastewater operators. During the year, 12 certification exams were conducted for operators. New certificates were issued to 72 operators and 61 other operators upgraded their certificates by passing certification exams. An additional 259 certificates were renewed for a further two years.

Pesticide Chemicals Branch

The Pesticide Chemicals Branch provides environmental protection through a comprehensive pesticide management program that includes: training, licensing and enforcement under the Agricultural Chemicals Act; issuing and monitoring of permits for use of restricted pesticides and the use of pesticides in environmentally sensitive areas; and administration, co-ordination and supervision of biting fly control programs and the Biting Fly Control Financial Assistance Program.

Training, Licensing, and Enforcement: Seminars and training courses were held in Fairview, Olds and Red Deer with approximately 350 persons in attendance. Lectures were also provided to an additional 500 persons through seminars held by other associations and government agencies. Approximately 240 persons registered in a home study training program for pesticide applicators and approximately 50 people completed the home study training program for pesticide dispensers.

The branch processed 590 pesticide applicator licence applications (including renewal applications), issued 127 pesticide vendor licences and maintained files on a total of 1,356 licenced pesticide applicators and approximately 1,245 licenced pesticide vendors. During the year, 74 letters of compliance regarding licensing requirements were issued. Restricted pesticide permits were issued as follows: 115 aluminum phosphide permits; 169 cyanide permits; 18 parathion/sulfotep permits; and seven structural fumigation permits.

Complaints to the Pesticide Chemicals Branch resulted in 156 investigations. Of primary concern were those dealing with chemical drift resulting from aerial and ground application methods, general pesticide misuse, off-site movement, unregistered uses and spills. These investigations resulted in 66 letters of compliance, three applicator licence suspensions and three prosecutions. The branch also conducted inspections of 147 pesticide retail/wholesale vendors for licence renewals.

Aquatic-Terrestrial Surveillance: A total of 274 permits were issued to apply pesticides on, in, or near water and for chemical vegetation management in the Green Area. Staff conducted 114 site inspections before, during and after pesticides were applied.

Some 12 monitoring programs were coordinated with permit holders to determine herbicide persistance and movement along streamsides and ditchbanks throughout Alberta. Six monitoring programs were conducted in the Green Area. The section continued to participate in the Canadian Forestry Service research project near Grande Prairie to assess the potential of Pronone 10G* as a forestry herbicide; and preliminary work began on assessing the potential of Sonar* as an aquatic herbicide.

Staff, through representation on the Aquatic Plant Management Committee, have begun to assess the effectiveness of utilizing Grass Carp (a plant eating fish) as a substitute for herbicides in irrigation systems.

The section participated in several public meetings on forestry spraying, aquatic weed control and pesticide research.

Biting Fly Program: Grants totaling $596,998 were awarded to 36 municipalities (total population 1.66 million Albertans) which participated in the 1987 Biting Fly Control Financial Assistance Program. One new program was initiated in 1987. Section staff advised or attended meetings to discuss mosquito control and financial aid with 15 other communities.

Branch staff carried out 117 routine monitoring and inspection checks of biting fly programs during 1987. Inspections of municipal pesticide storage facilities were also conducted. Several complaints of biting fly problems and pesticide applications were investigated. Information and technical assistance was provided to municipalities and the public through the media, visits and bulletins.

*Indicates registered trademark.

The section issued 42 permits (required under the Agricultural Chemicals Act) for municipal mosquito control and black-fly control programs. The efficiency of chemicals in use was monitored. Efficiency trials were conducted in Fort McMurray, Spruce Grove and Calgary.

Field days for municipal staff to upgrade their technical knowledge were held in Calgary and Stirling.

Branch staff continued to study the control potential of native predators and parasites in Alberta. The Chaoborus and flatworm predators were transplanted to mosquito larval habitats and will be monitored to determine if they can colonize these areas. Studies also continued on biting fly problems caused by irrigation practices in southern Alberta.

Monitoring of chemical treatments for black-fly control on the Athabasca River continued.

Special Program: Three new pesticide container collection sites were funded during the year. Negotiations to have the pesticide manufacturing industry take over the collection program continued through the year.

Removal of containers from pesticide container collection sites was stopped during the year due to public concern regarding landfilling of increasing numbers of plastic containers and because of the potential for recycling containers.

Co-operation and Extension Services: The Pesticide Chemicals Branch represented the department on a number of committees including the Safe Food Committee, the Pest Control Advisory Committee and the Interdepartmental Committee on Pesticides. The branch replied to numerous public inquiries and provided the general public with information through news releases, fact sheets and publications.

Waste Management Branch

Resource Recovery Program: The branch promotes the Four Rs of waste management - reduce, reuse, recycle and recover - by providing information and technology transfer to industry, municipalities and the public. Resource recovery grants are given to non-profit groups and municipalities to establish recycling projects or to a variety of agencies to develop innovative ideas or technology that will benefit the province as a whole.

Nine recycling projects were established in communities throughout Alberta. The Resource Recovery Grants for these projects ranged from $1,000 to $37,000. There were three paper collection projects, three for used oil, one for household glass collection and two for composting.

The two innovative composting pilot projects were setup at Ryley and in Medicine Hat. The village of Ryley collects compostable materials from each household on a weekly basis and the material is taken to a site where it is shredded and composted for future use. The city of Medicine Hat collects leaves and grass clippings from their recreation and park areas, composts the material and uses the end product for the city's horticultural programs. These projects will provide valuable information on composting for other communities in the province.

Approximately 200 service stations are participating in Alberta's Oil Drop program. The program provides convenient locations for do-it-yourself mechanics to properly dispose of used motor oil. To assist the public, the department maintains ongoing lists of participating stations.

The branch worked with the city of Edmonton on a planning and operations committee for the Edmonton "Think Recycle" pilot curbside recycling project. The project collects paper, glass and metal from householders in three areas of the city. Due to the positive response to the pilot project, the program will be city-wide in the fall of 1988.

Waste Management Assistance Program: The Waste Management Assistance Program has been in existence for 11 years. The program provides capital funds and technical assistance to develop regional waste management systems.

There are 21 regional waste management systems operating in Alberta. The systems constitute a total of 18 regional sanitary landfills and 115 solid waste transfer stations. These facilities have replaced nearly 180 old dump sites. Three new regional systems started operations in 1987. One existing system was expanded.

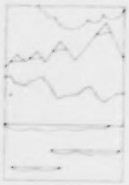
The program allocated $2.5 million to 15 regional waste management authorities during the year. This included funds for completion and expansion of systems and initial funding for new systems.

Five feasibility studies of regional waste management alternatives were conducted in the 87/88 fiscal year.

Beverage Container Program: Alberta's beverage container return system has been in operation for 16 years and provides an alternative to the disposal of beverage containers. The majority of containers returned through the system are recycled.

Currently, there are 211 licenced beverage container depots, 41 in urban and 170 in rural areas. In 1987/88, the department received 58 applications and 39 licences to operate depots were issued.

The beverage container legislation is under review and possible changes would expand the system to include the return of more containers and simplify the deposit structure.



STANDARDS AND APPROVALS DIVISION

The Standards and Approvals Division is responsible for the review of all industrial and municipal applications for Permits to Construct and Licences to Operate for new and/or existing facilities in accordance with the Clean Air Act, the Clean Water Act and regulations. The division also establishes ambient air, surface water, drinking water and plant decommissioning guidelines as well as standards for the control of hazardous wastes.

Air Quality Branch

The objective of the Air Quality Branch is to achieve and maintain acceptable ambient air quality through the use of the Clean Air Act and regulations, guidelines and policies which apply to industrial and other commercial operations.

New industrial developments and expansion phases of existing facilities are assessed to ensure that acceptable air pollution control systems were being applied and used. Existing industrial operations are also assessed when their licences to operate are renewed.

A total of 117 permits and 368 licences were issued under the Clean Air Act during the year (see Table 7). In addition, seven amendments to permits and 136 amendments to licences were issued.

Staff continued to participate extensively in Energy Resources Conservation Board (ERCB) public hearings and public inquiries. Branch staff were active on several committees dealing with acid rain causing emissions and in providing advice to the Review Panel on Environmental Law Enforcement.

The branch took part in two innovative approaches to environmental decision making involving the ERCB, other government agencies, local municipal authorities, oil sands companies and the Fort McKay Band.

The environmental review of an application to the ERCB for expansion of the Syncrude project was completed using the multi-party Syncrude Environmental Review Group (SERG). A similar process was started for the Suncor debottlenecking project using the Debottlenecking Application Review Team (DART).

Sulphur Recovery Guidelines: A review of sulphur recovery guidelines was completed in September 1986 with the issuance of a report by an Alberta Environment and ERCB task force. The review concentrated on the economics of sulphur recovery technology and the task force report was discussed with industry and representatives of public interest groups. During 1987/88, the task force recommendations were submitted to Alberta Environment and the ERCB for consideration and decisions on changes to the sulphur recovery guidelines.

Flaring Committee: The Government Industry Consultative Committee on Flaring (GICCOF) reviewed current technology and flaring practice in Alberta industry. The review will identify any research needs or regulatory changes that will benefit the environment in Alberta. A study of current technology and a study of current practice were initiated with funds from Environment Canada and Alberta Environment.

NOx Emissions: New requirements for the use of low NOx engines were formulated in order to reduce emissions from the increased use of compressor engines in the oil and gas industry.

Water Quality Branch

The Water Quality Branch seeks to maintain acceptable quality of Alberta's surface and ground water by regulating pollution sources. Branch staff: assess and licence the design, construction and operation of industrial facilities and other operations; initiate and participate in studies and developments which can have an impact on water quality in the province; and continue to develop and update provincial water quality standards.

A great deal of staff time is spent assessing new and existing industrial plants and operations to ensure they are environmentally acceptable. Environmental terms are also recommended for intensive livestock operations. A total of 43 permits and 203 licences were issued for the construction and operation of industrial facilities (see Table 8); 16 Letters of Permission were granted to permit the non-routine discharge of liquid effluents; and 44 livestock operations were reviewed.

During 1987/88, branch staff coordinated reviews of industrial wastewater treatment ponds and landfill sites to determine the impact seepage may have on ground water quality. Staff participated in ERCB hearings and provided advice to regional planning commissions, local municipal governments and other agencies on the environmental effect of intensive livestock developments. Staff were active in the development of models to examine mixing zones and water quality effects.

Other areas of involvement were river basin planning studies, new industrial process and wastewater treatment technology studies and microbiological assessments of agricultural waste management practices.

An increase in pulp mill proposals required additional branch activity in the development of standards and assessments of the potential impact of mills on water quality.

Industrial Wastes Branch

The branch is responsible for: preparing approvals for facilities where a major part of the operation involves the storage, treatment or disposal of hazardous wastes; assessing the acceptability of proposals for landfilling, land treating or deepwell injection of industrial wastes; training visible emission readers; and developing and implementing a program for the reclamation of decommissioned industrial facilities. The branch plays a lead role in the ongoing development of the hazardous waste program.

The branch provided representation on three federal-provincial committees which dealt with low level radioactive waste management, hazardous waste management and amendment of the Environmental Contaminants Act (Canada); and the Clean Air Act and/or Clean Water Act.

Municipal Engineering Branch

The Municipal Engineering Branch ensures that municipal water supply systems are designed and operated in a manner that will produce good quality drinking water and that sewage treatment works will provide a high level of both public health and environmental protection.

The review and approval of all municipal water, sewage and stormwater projects undertaken in the province and the licensing of water and sewage treatment facilities continued to be a main activity of the branch.

A total of 295 permits to construct were issued and a total of 141 licences to operate were issued or renewed for municipal systems. (See Table 9.) Letters of permission authorizing land application of either sewage effluent or sludge, special treatment experiments and other requests such as dye tracer studies, or cleaning of anaerobic ponds, were also issued (Table 9).

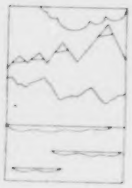
The branch continues to develop and update standards and guidelines and participated in related technical activities. A review and update of overall standards and guidelines for municipal water supply, wastewater and stormwater facilities was completed. The revised standards and guidelines were distributed to all municipalities and municipal consultants in the province. These will be used to determine if proposed water and sewage work requires approval under the Clean Water Act.

Branch involvement in the National Sanitation Foundation program to develop standards for products and chemicals used in the treatment, transport and storage of water was completed. Comprehensive standards have been published and will likely be adopted by most regulatory agencies in Canada and the United States.

The branch began work on a manual to assist municipalities in the production of drinking water to meet the Guidelines for Canadian Drinking Water Quality. This manual is a cooperative effort among the provinces and Health and Welfare Canada. The new Guidelines for Canadian Water Quality (1987) were distributed throughout the province.

Branch staff continued to assist municipalities and engineering consultants with the planning, selection and design of water supply systems and sewage works.

Information was provided to the Department of Transportation and Utilities on the environmental priority of municipal projects being considered for financial assistance under the Alberta Municipal Grant Program.



EARTH SCIENCES DIVISION

The division comprises the Soil Protection and Ground Water Protection branches. The division provides technical expertise in the development, protection and reclamation of soil and ground water resources in the province. Major activities include administration of the Ground Water Development Act; monitoring of acidic deposition, operation of observation well networks, participation in the Drought Emergency Water Supply Program; monitoring of landslide and earth tremors; mapping of the base of ground water protection; operation of earth sciences related laboratory; providing ground water information services to the public and industry; and conducting landfill investigations.

Ground Water Protection Branch

The Ground Water Protection Branch provides province-wide investigative and consultative services in the areas of shallow ground water contamination, shallow ground water quality monitoring and ground water seepage problems. Major programs included: evaluation and monitoring of modified and regional landfill sites; investigation of irrigation headworks; monitoring of shallow ground water contamination; high quality ground water sampling; and the review of country residential subdivision applications.

Landfill Investigations: Hydrogeological investigations at prospective regional and modified landfills were continued as a service to local governments. Investigations are conducted to ensure that landfills are located in areas where the risk of ground water contamination is low. In the landfill site selection process, hydrogeologic constraint maps, office evaluations and site specific hydrogeologic testing are employed. Reports, containing results of hydrogeological investigations, were prepared for 22 prospective regional and 25 modified landfill sites.

Permanent ground water monitoring systems have been established at 17 regional and three modified landfills. Monitoring activities typically consist of recording water levels and collecting ground water samples for chemical analysis. Monitoring results for each regional landfill are reported annually.

Irrigation Headworks: Investigations of soils and shallow ground water conditions along canals operated by the department were continued to locate and define the extent of existing or potential canal seepage. The results are used to design interceptor drains, canal linings, relocation alternatives and other means of controlling canal seepage.

Investigations were undertaken for Reach 5 of the Lethbridge Northern Irrigation District Headworks Canal and also for a major section of the United Irrigation District Main Canal. Other seepage control studies were undertaken for a number of areas along the Bow River Irrigation District Headworks Canal and the Western Irrigation District Headworks Canal system. Post-construction evaluations to study the effectiveness of seepage control measures implemented within the rehabilitated sections of the Lethbridge Northern Irrigation District Main Canal system were continued.

Shallow Ground Water Contamination: Branch personnel assisted in the evaluation and/or clean-up of 25 soil contamination problems caused by petroleum leakage from underground storage tank systems. An inventory of underground storage tanks in Southern Alberta was completed. Branch staff were actively involved in provincial and national initiatives to improve management of underground storage tank systems.

The branch was involved in the assessment and monitoring of contaminant clean-up programs at nine industrial sites. Staff reviewed technical designs for 16 municipal and three industrial wastewater ponds to ensure compliance with provincial seepage control criteria.

Industrial Plant Monitoring: Branch personnel provided technical assistance to regulatory authorities in evaluating ground water monitoring proposals and data from industrial plants. Ground water monitoring is required around most industrial facilities in order to obtain a Licence to Operate pursuant to the Clean Water Act. In the past year, ground water monitoring proposals and/or monitoring data were reviewed for approximately 45 industrial plants (predominantly sour gas plant facilities).

High Quality Ground Water Sampling: A province wide ground water quality monitoring project began in 1985. The purpose of the project is to determine the natural ground water quality of specific aquifers, using strict sampling protocol.

A total of 78 wells were sampled this year, including 35 which had been sampled the previous year. Duplicate sampling is required to ensure results represent true natural ground water quality.

The water analysis consists of 18 routine parameters, 14 trace/heavy metals, total organic carbon and chemical oxygen demand. Nine parameters are measured in the field using a mobile laboratory.

Country Residential Subdivisions: A total of 43 technical submissions supporting country subdivision applications were reviewed and evaluated. Several meetings were attended to discuss ground water availability and related subjects with municipal councillors and staff.

Soil Protection Branch

The Soil Protection Branch provides investigation and consultation on soil issues for activities licensed by Alberta Environment, in order to protect, improve and promote wise use of the soil resource. The branch has expertise in soil chemistry, soil physics, soil microbiology, soil pollutant chemistry and land use. Major branch programs include soil effects from acidic deposition, land spreading of municipal and industrial wastes, reclamation and earth sciences related laboratory support.

Land Spreading of Municipal and Industrial Wastes: Investigations into the suitability of land spreading of wastes continued. These wastes included wastewater and sludge from municipal and industrial sources.

Studies continued in the Calgary and Edmonton areas to determine soil concentrations of plant nutrients and heavy metals after sewage sludge application. Assessment work on waste suitability for land application and the use of biological toxicity testing techniques is ongoing. Staff continued to work with the Drilling Wastes Review Committee, an industry/government group reviewing drilling waste management guidelines.

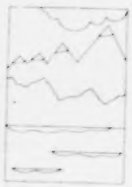
Soil Acidification: Monitoring the seventh year of soil sampling, in a 44 year long-term soil acidification monitoring program, was completed. The program measures sensitive soils in areas near sources of acid forming emissions as an early warning to potential long-term effects over larger areas.

Soil data and analytical quality assurance data submitted by industry under the Air Monitoring Directive AMD-86-1 program continued to be assessed. This directive requires sour gas plants to monitor soils for acidification.

Reclamation: Studies of field methods for identifying soil contaminants, clean-up criteria and clean-up verification continued.

Laboratory and field work were undertaken to determine the amount of elemental sulphur that can be left in sulphur base pads and still be reclaimed using lime without adverse soil, plant or ground water impact.

Analytical Support: Laboratory analysis of soil, water, plant and waste materials were conducted in support of divisional programs and, to a lesser extent, to other health, agriculture and water resources agencies, in southern Alberta. A total of about 15,100 samples were analyzed for about 93,200 measurements. Of these, some 53,200 and 37,400 measures were made on 12,400 soil and 2,400 water samples, respectively.



RESEARCH MANAGEMENT DIVISION

The Research Management Division (RMD) seeks to: provide timely scientific and technical advice and information to divisions within Alberta Environment; coordinate the department's environmental research requirements with external agencies; and plan and carry out research on environmental matters pertinent to departmental and provincial needs. The division also coordinated departmental research carried out at the Alberta Environmental Centre.

In order to carry out these objectives, the division combines diverse skills such as project management, budgeting and financial control, contracting and publication editing, with comprehensive scientific knowledge. Expertise is drawn from such areas as hydrology, climatology, pedology, biology, chemistry, meteorology, ecology and sociology.

During the 1987/88 fiscal year, research programs included: acid deposition; air quality/climate; biophysical resources; environmental contaminants; water treatment and waste management; water resources; environmental information and risk assessment. The functions of the division were transferred to the Alberta Environmental Centre at the end of the 1987-88 fiscal year.

The Research Management Division managed 28 scientific contracts, ranging from major interdepartmental projects, such as the Cold Lake Hydrogeology Study, to the organization of workshops and the publication of monographs.

Six final reports on research projects were published during the year and a number of articles appeared in scientific journals or conference proceedings. Additionally, researchers submitted interim or progress reports and division staff also published material internally, through other agencies, or in conference proceedings or journals.

Research Programs

Acid Deposition Research: This program involves research on the environmental impact and the medium-to long-range transport, of acid forming emissions (oxides of sulphur and nitrogen). The research will provide information to help Albertans understand the potential effects of acid forming emissions on soil, water, vegetation and human health. Results will be used to evaluate and refine Alberta's air quality standards and to help plan industrial development in the province.

Research is conducted in three program areas:

1. Planning continued on a research program to determine the potential impact on the northern forested areas of the province, including the oil sands areas.
2. The Western and Northern Canada long-range transport of air pollutants (W&NC-LRTAP) program involves cooperative research with British Columbia, Saskatchewan, Manitoba, the Northwest Territories and Environment Canada. The objective is to investigate the medium and long-range transport of air pollutants and their possible environmental effects.

   Research activities undertaken during 1987-88 focussed primarily on the evaluation of Mesoscale transport/deposition models; the evaluation of the role and importance of particulate matter in determining the chemistry of precipitation and deposition; and developing target loadings for sensitive ecosystems.
3. The Alberta Government/Industry Acid Deposition Research Program (AG/IADRP) is an $8 million project of Alberta Environment, the Energy Resources Conservation Board, the electrical utilities and the Canadian Petroleum Association (CPA). It is designed to assess the effects of acid forming gases on the environment and human health.

The biophysical research component of the program concentrates mainly on agricultural areas in the southern part of the province. The first critical phase of this research involves: a characterization and quantification of local and regional air quality and an assessment of the potential impact on the environment; an inventory of sulphur dioxide and nitrogen oxide emissions in Alberta; and a world literature review on the effects of acid deposition on vegetation, soils and surface and ground waters. Emissions inventories and world literature reviews were completed and released to the public in November 1987.

Air Quality/Climate

The objectives of the air quality program are to characterize and quantify atmospheric pollutants and delineate their effects on air quality, the environment and climate. Research is focussed on priority concerns, such as flaring. Research results will be used to determine the best possible management strategies and regulatory controls required to prevent or mitigate degradation of air quality.

The climate program examines the impact of climate variability on the management and development of Alberta's economic and human resources. Research results will be used to develop and implement strategic plans to minimize the potentially adverse impact and maximize the positive impact of climate variability. This will complement the Canadian Climate Program as recommended by the Canadian Council of Resource and Environment Ministers. The Alberta Climate Advisory Committee (ACAC) coordinates research on a provincial and national level. This interdepartmental Committee (Environment, Public Safety Services, Economic Development and Trade, Agriculture, Forestry, Lands and Wildife and the Alberta Environmental Centre) includes representation from Atmospheric Environment Service (Environment Canada), the Alberta Research Council, the Canadian Petroleum Association, the Alberta Climatological Association and academia.

The ACAC, in cooperation with Saskatchewan Climate Advisory Committee, Manitoba Climate Advisory Committee and the Canadian Climate Centre, held a symposium/workshop on the Impact of Climate Variability and Change on the Canadian Prairies in September 1987. More than 150 persons attended the meeting. The proceedings have been published and the recommendations from the workshop are under review.

Biophysical Resources

This research program combines reclamation and geoscience programs with two new programs of biotechnology and resource inventory. During 1987-88 research was undertaken only in the reclamation and geoscience programs.

The Reclamation Research program identifies better methods of reclaiming disturbances created by activities such as mining, drilling and pipeline construction. For example, research is being done to determine methods of rebuilding productive soils; to identify changes in surface water and ground water after disturbance and reclamation; to develop native plant species for reclamation; to control erosion and to improve materials handling operations.

The interdepartmental Reclamation Research Technical Advisory Committee (RRTAC) sets research priorities that are reviewed each year. RRTAC members are from the Alberta departments of Environment, Agriculture, Energy and Natural Resources and the Alberta Research Council.

In 1987-88, RRTAC provided approximately $500,000 from the Heritage Savings Trust Fund to reclamation research. Government and industry committees coordinate research in three program areas: Plains Coal Reclamation Research; Oil Sands Reclamation Research; and Oil and Gas Reclamation Research.

The Geoscience research program coordinates research on natural phenomena, such as landslides and earthquakes, which may pose a threat to human life and property, as well as research on natural resource development and land use and their impact on the environment. It includes research in geology, geophysics, civil engineering and soil science.

Environmental Contaminants

This program examines contaminants within Alberta, their fate and their environmental effect.

The five programs under Environmental Contaminants are: Oil Sands Extraction and Discharge; Pesticides; Organic Pollutants; Heavy Metals and Other Ions; and Decommissioning Activities.

Research activities this fiscal year focussed on priority concerns of Oil Sands Extraction and Discharge, Pesticides and Decommissioning. The oil sands extraction and discharge program researched fish tainting, persistence and movement of contaminants (fugacity) and the fate of oil sands tailings contaminants. The pesticides program investigated aquatic macrophyte control, insect spraying activities and fish toxicity. The decommissioning program examined phosphogypsum ponds and carried out an inventory of underground storage tanks.

Water Treatment and Waste Management

This program coordinates all Alberta Environment research aimed at improving the understanding of the principles of water and wastewater treatment technology and waste disposal. The objectives of the program are to address public concerns and to develop technology for water and waste treatment.

Research focussed on pulp and paper wastewater treatment options; Giardiasis detection and control methodology; and various industrial and municipal water and wastewater treatment technologies.

Pulp and paper research centred on evaluations of wastewater treatment options for the chemithermomechanical pulping process. Giardiasis research at the Kananaskis Centre continued with the development of detection techniques and assessment of some conventional and non-conventional potable water treatment options. A major international conference on Giardiasis detection and water treatment was held in February 1987.

Finally, techniques for microbial degradation of hydrocarbon contaminated soils in Alberta were reviewed as were potential oil sands tailings pond treatment technologies.

Water Resources Research

Under this program, research is carried out on the quantity and quality of surface water and ground water and on the impact of industrial developments and activities on water resources.

Water quality research included ion and nutrient levels in Alberta lakes and control of aquatic weeds and salinization along irrigation canal systems.

A project studying the physical phenomenon of snowmelt infiltration into frozen prairie soils resulted in the capability to forecast soil moisture conditions of prairie soils in early spring.

Two major programs were jointly funded with the Alberta Research Council. The hydrogeology of the Cold Lake area is investigating the ground water flow regime on a regional scale and evaluating deep well disposal practices associated with the in situ heavy oil exploration activities. A study of surface water engineering is studying such issues as bedload and scouring in gravel bed rivers, riverbank erosion and protection, development and implementation of a computerized river data base and river ice formation and breakup processes.

Environmental Emergencies and Risk Assessment

This program identifies and evaluates risks from uncontrolled releases of pollutants into the environment and develops strategies to protect the environment in emergencies.

Environmental Information

This program identifies environmental issues of public concern as well as the policy implications of all research results.

Environmental Evaluation Services

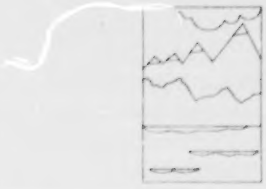
Environmental Evaluation Services regulates resource development by requiring environmental impact assessments for major developments, assessing development, exploration and reclamation applications, dealing with regional planning commissions and the Energy Resources Conservation Board and administering restricted development areas.

In January 1988, the Environmental Assessment Division became part of Environmental Protection Services and the Land Reclamation Division is now under Finance, Administration and Land Reclamation Services.

The Heritage Savings Trust Fund continued to fund research and reclamation of abandoned and derelict lands. Research projects include the Plains Coal Reclamation Research Program (PCRRP) designed by the provincial government and members of the coal industry to answer questions relating to ground water and soil reconstruction in the Plains coal mining zones. Two main projects, the Plains Soil Reconstruction Project which will tell how to rebuild agricultural soils after mining and the Plains Hydrology Reclamation Project will show what happens to ground water during mining and after reclamation and how to rebuild the landscape to enhance agricultural potential.

The St. Albert sewage lagoon, through a joint effort with the Fish and Wildlife Division of Forestry, Lands and Wildlife, is being reclaimed to a put and take fishery. Reclamation is also underway on the Beaumont sewage lagoon. This area is the potential site for a high school and recreational development. Two gravel pits on Calgary's Nose Hill have been reclaimed as an initial step in the proposed development of Nose Hill as a park area.

In 1987, the largest reclamation project undertaken by the Reclamation Branch was initiated at the Blairmore Big Pile coal slack pile and the Greenhills Mine site. To date, cleanup has been completed around the mine site and all preparatory work, including the haulroad and dump site creek diversion, is in place to facilitate reclamation of the pile.



ENVIRONMENTAL ASSESSMENT DIVISION

The division develops, maintains and coordinates Alberta's environmental impact assessment (EIA) system, related public participation programs and provides services in remote sensing technology.

EIAs are required for most major resource developments proposed in the province, such as new oil-sands mining projects, sour gas processing plants, coal mining projects, power plants, refineries and petrochemical facilities, pipelines, transmission lines, recreational developments and water resource projects.

The division also administers the restricted development area (RDA) regulations which designate transportation utility corridors and areas requiring special environmental protection.

Ministerial consent is required for most land-use changes in restricted development areas. The RDA regulations are also the basis for implementing the Calgary and Edmonton transportation/ utility corridors.

The division also provides environmental advice on applications for subdivision and on a variety of land use proposals throughout the province.

Environmental Impact Assessment Review Branch

This branch evaluates proposals to determine if environmental impact assessment reports are needed, determines the scope and content of EIA documentation and coordinates the interdepartmental review of these projects.

During the 1987/88 fiscal year, the branch dealt with a total of 86 projects of which 81 were new referrals. Five project reviews carried over from the previous year. (See Table 19) The branch dealt with 16 major projects, including carry overs and new projects. Some 12 of these major projects, four oil sands projects, five industrial developments, two oil and gas developments and one recreational project required EIAs. Four EIA reviews were completed, five are active and three are inactive.

A total of 62 project reviews were completed, 18 are active and five are inactive.

The EIA Review Branch coordinated the participation of the Crown at the ERCB public hearing into the proposed Shell Canada Prairie Bluff natural gas wells. It coordinated the development of a departmental position on the need for ministerial approvals for certain types of oil sands projects and coordinated a departmental position on the review of the proposed ERCB oil sands regulations. In association with the ERCB, it completed its review of duplicate reporting requirements and information requirements for oil sands applications. It also assisted in developing a departmental position on water recycling guidelines for oil sands developments.

In addition, the EIA Review Branch assisted in the preparation of departmental information pertaining to the Sturgeon Lake Indian land claim and identified departmental interests in the South Heart River reservoir.

The director of the Environmental Assessment Division administers the Subsidiary Agreement Concerning Environmental Impact Assessments of Projects in Alberta With Implications for Canada and Alberta. The branch assisted the director in the exchange of information with Environment Canada on a number of projects. All provincial projects requiring EIAs were referred to Environment Canada.

Remote Sensing Centre

Albertans continued to benefit from the technology of remote sensing through the Alberta Remote Sensing Centre in Edmonton. The centre's facilities and services were used by the provincial and federal governments, private industry, educational institutions and the public for the survey and management of Alberta's natural resources and environment.

The staff, facilities and programs assisted multidisciplinary users in the acquisition, analysis and application of remotely sensed imagery and digital data. The centre's Landsat (resource satellite) microfiche collection, imagery library and on-line technical data retrieval system provided users with current details of Canadian Landsat imagery and of technical documents. High resolution images and data acquired by the French SPOT satellite and captured by Canada's satellite receiving stations were also picked up by Alberta managers and researchers.

The Image Acquisition and Analysis Section's comprehensive image analysis facilities made available specialized optical and digital analysis equipment. Staff assisted in interpreting satellite and airborne data. The Applications Section provided advice and information on techniques for using remotely sensed imagery to meet client needs. The section's Technology Transfer Program co-ordinated specialty courses, seminars, workshops and briefings throughout Alberta and produced technical literature. Two centre-supported projects demonstrated cost-effective applications of remote sensing techniques in Alberta: Use of Satellite Imagery in GIS Based Regional Planning and Evaluation of RADAR Imagery of Geologic Applications in Alberta.

The centre published the 1987 Remote Sensing Newsletter and Landforms of Alberta.

Community Affairs Branch

The Community Affairs Branch is involved in the design, coordination and monitoring of public participation programs for a wide range of departmental projects and programs. The branch also facilitates public participation in departmental regulatory procedures used to achieve the protection, improvement and wise use of Alberta's environment.

Environmental Impact Assessment: Communities were assisted through responses to requests for information and advice on environmental issues and the regulatory process. Branch staff advised proponents on the requirements for public participation programs and monitored proponent programs for conformity with the intent of the EIA guidelines regarding public participation.

The branch assisted with 18 individual projects throughout the province. These included five industrial development projects, one coal project, five oil sands projects, two pulp mills and five sour gas /oil plants.

Branch staff also responded to requests from individuals and communities to inform Albertans about the EIA process and regulatory enforcement and monitoring procedures. Assistance was provided to a number of advisory committees and special interest groups, including the Community Advisory Committee of Cold Lake, the Genesee Power Project Committee, the Keephills Power Project Steering Committee, the Quirk Creek Community Gas Plant Committee, the Little Bow Advisory Committee, the East Parkland Liaison Committee, the Willow Creek Basin Advisory Committee, the Northern Alberta Environmental Education Project, the Alberta Environmental Network and the Caroline Gas Field Advisory Board.

Department Programs: Branch staff facilitated public participation in many departmental projects including the Beaver River Cold Lake Ground Water Allocation Task Force, the Whitford Lake Water Management Study, the Forty-Mile Coulee Reservoir Development, the Milk River Basin Study, the Willow Creek Basin Study, the Hutch Lake Development and Help End Landfill Pollution (H.E.L.P.).

The branch also liaised with various other government departments, academic institutions, local authorities and special interest groups to foster ongoing dialogue and encourage ideas and information exchange. Branch staff directly participated in special projects such as the Ft. McKay Environmental Education Committee and the use of herbicides in forest management.

Land Use Branch

The Department of the Environment Act (Section 16) provides for the designation of restricted development areas (RDAs) in the province. At the beginning of this fiscal year 11 of the 13 RDAs designated since 1974 were still in place. The two main reasons for RDA designations are the need for special environmental management in certain areas and for protection of transportation/utility corridor lands. In June the Blue Ridge RDA was deregulated, since other land use controls are now in place in this area. Administration of the remaining 10 RDAs is the responsibility of the Land Use Branch.

Subdivision and development applications and most proposed land-use changes are reviewed to determine whether they conform to the regulations set up for a specific RDA. Ministerial consent is required before there can be any change in land use.

During the past year, 189 requests for ministerial consent were received. Of these 178 were approved and one did not require consent. The remainder were either awaiting decision, withdrawn or regarded as information. In terms of applications processed, the more active RDAs in the province were those in Calgary and Edmonton (see Table 20).

The branch also evaluates proposals for subdivisions and for a wide variety of land uses. Comments are provided to local planning authorities throughout the province. The branch's objective is to protect high quality agricultural, recreational and high water yield lands, as well as water bodies, from inappropriate usage.

Applications for changes in land use and subdivision are referred to the branch by the 10 regional planning commissions, the Planning Services Division of Alberta Municipal

Affairs, the cities of Airdrie, Camrose, Leduc, St. Albert, Fort McMurray, Fort Saskatchewan and Lethbridge, the counties of Grande Prairie, Parkland and Strathcona and the Municipal District of Rocky View. Table 21 outlines these activities.

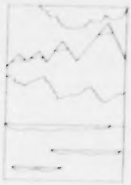
The branch comments on behalf of the department regarding compliance with the Land Conservation Guidelines, susceptibility to flooding, bank and slope stability, risk of erosion, surface drainage, availability of domestic ground water supply, potential air and water pollution and suitability of the soil for sewage disposal.

Branch staff assessed numerous major residential and cottage resort subdivisions near water. Much time was spent with developers reviewing applications for cottages and rural developments and pointing out the risks of sewage contamination, erosion due to vegetation removal, overcrowding and over use of the lakes.

In 1987/88 the number of applications processed decreased from 1,419 in the previous year to 1,379.

Staff represented the department at Alberta Planning Board hearings on subdivision application appeals by developers. Staff also reviewed 14 applications for annexation of rural lands to urban municipalities as a result of referrals from the Local Authorities Board.

WATER RESOURCES MANAGEMENT SERVICES



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A.R. Strome, P.Eng.
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Water Resources Administration Division

Dr. R.B. MacLock, Ph.D.
Acting Director
Planning Division

Water Resources Management Services is responsible for the overall management of water resources within the province and for water resource matters held in common with other provinces and the federal government. These responsibilities are carried out by the Services' four divisions: Technical Services, Development and Operations, Water Resources Administration and Planning.

Water Resources Management Services represents the province in interprovincial and federal/provincial water management matters and implements water agreements with the government of Canada. In this regard, the Assistant Deputy Minister represented Alberta on the Prairie Provinces Water Board and on the Mackenzie River Basin Committee. The Assistant Deputy Minister also represents Alberta Environment on the Alberta Water Resources Commission and the Montana - Alberta Border Advisory Committee. During 1987 - 88, he served as Chairman of the Oldman River Dam Review Board.

Alberta Water Resources Commission

The Water Resources Commission was involved in the development of proposed guidelines for irrigation expansion in the South Saskatchewan River Basin. An interdepartmental team to identify instream flow requirements was established. The commission is preparing a report on wetlands management policies with assistance from an interdepartmental steering committee. Research funds were used to support work dealing with on-farm water management, development of water management plans for watersheds in northern Alberta and the Atlas of Alberta Lakes.

Prairie Provinces Water Board (PPWB)

The PPWB comprises representatives from the federal government and the provincial governments of Alberta, Saskatchewan and Manitoba. Established in 1948, it administers the 1969 Master Agreement on Apportionment of eastward flowing rivers and makes recommendations on water resource matters that concern more than one jurisdiction. During the year, the principle activities affecting Alberta were:

Apportionment Administration: The board approved a hydrometric monitoring program for 1988-89. The report, "Handbook for Administration of the Apportionment Agreement," was accepted by the board for its information and use. The terms of the Master Agreement on Apportionment were met over the 1987 apportionment period. Although drought conditions were reflected in extremely low flows on the South Saskatchewan River for the first three months of 1988, the terms of the master agreement were fully met to March 1988. Flows on the Lodge, Middle and Battle Creeks were also extremely low.

Committee on Hydrology: The committee approved the list of meteorological stations used by the PPWB for interprovincial apportionment purposes. The committee reviewed and approved four natural flow study reports; three additional studies are under review. Guidelines for a proposed evaporation study were prepared.

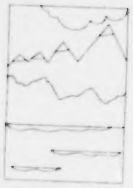
Committee on Groundwater: A report entitled, "Potential Interprovincial Groundwater Concerns," was prepared and submitted to the board. The board accepted the report and agreed the committee should proceed with a review of current procedures for licensing and for dealing with groundwater contamination.

Committee on Water Quality: The committee updated the PPWB Water Quality Contingency Plan. The 1988-89 Water Quality Monitoring Program was approved. The committee reviewed drafts of the Water Quality Indicators Supporting Documents for the South Saskatchewan, Red Deer (Alberta), North Saskatchewan, Battle and Saskatchewan Rivers. Discussions continued regarding the use of water quality indicators for assessing and identifying water quality at interprovincial boundaries and for resolving potential interprovincial water quality concerns.

Mackenzie River Basin Committee (MRBC)

The Mackenzie River Basin Committee was established by the governments of Canada, British Columbia, Alberta and Saskatchewan. Representatives from the Northwest and Yukon Territories are also represented on the Committee. The MRBC is responsible for the exchange of information on water and related resource activities and developments in the basin and for advising on implementation of recommendations from the 1981 Mackenzie River Basin Study Report.

The jurisdictions in the basin have supported the recommendation to develop transboundary water management agreements. In 1987-88, Alberta continued discussions with the Northwest Territories, supported by progress in work at the technical level. Discussions with Saskatchewan also continued; British Columbia agreed to resume discussions in 1988.



TECHNICAL SERVICES DIVISION

The division co-ordinates the department's operations in the physical and quantitative assessment of the occurrence, movement, control and effect of water; administers the Groundwater Development Act and services the department's engineering survey needs. The division provides information, expertise and engineering studies in hydrology, river flow forecasting, river engineering, surveying and groundwater development.

Survey Branch

The Survey Branch provides land and water surveys to the department. Data collected are used for the investigation, implementation and management of departmental projects, for the management of the province's water resources and to contribute to the data base of land survey and hydrometeorological information. The branch carries out its responsibilities through two sections, the Land Survey Section and the Water Survey Section. The branch also operates the Technical Services Division Records Centre which provides land survey and hydrometeorological data and related information to the department, to consultants and to the general public.

Land Survey: Engineering and control surveys were performed and arrangements were made for legal surveys, aerial photography and mapping services for the department. There were a total of 542 projects and the cost of contracted services was $533,740.

Some of the larger projects for which surveys were carried out were: Western Irrigation District Main Canal; Parlby Creek/Spotted Lake; Whitford and Rush Lakes; Lethbridge Northern Irrigation District Main Canal, Reach 5 construction; and Pinepound Coulee Syphon Replacement.

Water Survey: Hydrometeorological data were gathered by the section's field staff and through two federal-provincial cost-sharing agreements.

During 1987, the following data collection stations were operated by section staff:

- Lake level	238 stations
- Recording streamflow or water level	64 stations
- Non-recording streamflow	99 stations
- Snow courses	118 stations
- Snow pillows	12 stations
- Recording precipitation	28 stations

Major flooding in the Simonette basin was monitored by section staff.

Under the terms of the Federal-Provincial Cost-sharing Agreement for Meteorological Programs and Stations, 25 stations were operated at a cost of $12,532. Under the terms of the Federal-Provincial Cost-Sharing Agreement for Water Quantity Surveys, 473 stations were operated. Alberta's share of the costs in 1987/88 was $830,579.

Expansion of the real-time hydrometeorological network, by the installation of an additional satellite data collection platform in the Oldman Basin and 11 landline systems in the southern part of the province, brought the total network to 100 stations. Data gathering activities continued in the Peace Athabasca Delta with particular emphasis on monitoring the break through from the Embarras River to Mamawi Lake. All monitoring in the Spring Creek Basin near Valleyview ended in October 1987.

River Engineering Branch

The River Engineering Branch provides expertise in the area of river morphology and dynamics. General areas handled by this branch include: river erosion protection and river training; flooding analysis and preparation of flood risk maps for land bordering on rivers and lakes; design and analysis for flood reduction schemes; ice jam monitoring and control at freeze-up and breakup; evaluation of the impact of water management works (dams, weirs, etc.) on the existing regime of rivers; river engineering input to permission for gravel mining, pipeline crossings, bridges, culverts, intake and outlet work; and river data collection (flood and erosion surveys).

Erosion Protection and River Training

Problem evaluation and preliminary design reports related to river erosion, sedimentation and stabilization were prepared for 30 projects. Major projects included: Red Deer erosion near Kevisville; East and West Prairie Rivers - review of channel erosion and degradation; Town of Slave Lake - water intake sediment problems; Baptiste Creek - channel design; Parlby Creek - erosion protection; Shoal Creek channelization; Clearwater Dike project near Butte; Uinited Irrigation District rehabilitation - sediment assessment; and design of

fish habitat improvement for Jumpingpound Creek, Race Horse Creek, upstream and downstream of the Oldman Dam, the Bow River near Canmore and the Crowsnest River.

Flood Risk Analyses

Flood risk maps are prepared so future land development can properly treat floodplain areas. The object is to keep development out of the flood hazard areas. Major reports completed were: Lethbridge Flood Study - Revised Analysis; North Saskatchewan - 1986 Highwater Mark Report; Oldman Dam Reservoir PMF and 1:100 Flood Hazard Mapping; Whitecourt Floodplain Delineation; Athabasca Basin - Flood Damage Study Input; and North Saskatchewan River - Cloverdale and Rossdale Floodway.

Some 107 subdivision applications were assessed for flood risk as an input to planning commission work and studies of flood potential were carried out at numerous other locations.

Ice Jam Monitoring and Control

Both break-up and freeze-up ice fronts were monitored at the town of Peace River and at Fort McMurray. Extensive work was done with the Alberta/B.C. Hydro Joint Task Force for the Peace River to set the freeze-up level of the Peace River at Peace River.

Ice monitoring was done on the North Saskatchewan River at Rocky Mountain House and on the Red Deer River downstream of the Dickson Dam.

Assessment for Permits and Licences

During the year, 16 bridge/culvert crossings, 37 sand and gravel, 56 pipeline crossings and 52 others were reviewed.

Hydrogeology Branch

This branch addresses hydrogeological, geological and geophysical issues with emphasis on orderly ground water development. Major programs include the administration of the Ground Water Development Act, operation of observation well networks, compilation and dissemination of ground water data, geophysical monitoring, hydrogeological mapping, liaison with the water well drilling industry and ground water users and application of earth sciences to other programs as required. During the fiscal year, the Hydrogeology Branch was amalgamated with the Technical Services Division.

Ground Water Evaluation Section:

Provincial Observation Well Monitoring: An expanding network of more than 250 observation wells ranging in depth from five to 285 metres has been designed to provide information on specific water producing zones or aquifers. Most aquifers used for domestic and industrial supplies are monitored. The monitoring has so far indicated a lowering of ground water levels only in the vicinity of major ground water withdrawals. In most areas the water level fluctuations vary seasonally within an expected range.

The observation wells have been made available for a joint monitoring project with the Ground Water Protection Branch. This involves periodic detailed well sampling and aquifer testing. The data assists in monitoring of ground water quality changes.

Major additions to the observation well network occurred in the vicinity of High Level, Grande Prairie, Provost and the Oldman River Dam. Also, an instructional observation well was drilled in Edmonton for the Northern Alberta Institute of Technology and some deep drilling was conducted for Alberta Agriculture near the Milk River.

During drilling of an observation well west of High Level, an unexpected major gas blowout occurred from approximately 90 metres depth. There was no loss of life or equipment but a report, "Observation Well Test Hole Drilling and Natural Gas Blowout - Zama South", has been published about this potentially dangerous occurrence.

Inspection and Information Section:

The inspection section is responsible for the administration and enforcement of the Ground Water Development Act and regulations which ensure protection of ground water resources by regulating the construction and abandonment of water wells.

Final results from a study on corrosion of water well steel casing will be used in the review of minimum standard requirements for well casings.

Ground Water Information: The Ground Water Resources Information Service, the main data bank for ground water information in the province, now has more than 285,000 files, all available for public consultation. Additionally, the Alberta Well Library, containing geologic information from the oil and gas industry on 283,000 microfiches, has been recently acquired.

Technical Support Section:

Oldman River Dam Area Monitoring - A three station seismic monitoring array, which was installed in November 1986 to detect reservoir induced seismicity, has not detected any local seismicity in the future reservoir area.

Five ground water monitoring wells were established downstream of the dam site to monitor changes in the ground water regime during reservoir impoundment.

Monitoring at Raven River - At the request of Alberta Forestry, Lands and Wildlife, a temporary seismic monitoring station has been established at the Raven Brood Trout Station near Caroline. This was to allay concern for the threat posed to the integrity of the spring fed water supply by seismic oil and gas exploration activities in the area. In conjunction with an observation well on site, the seismic station has been monitoring disturbances to the aquifer supplying the spring. To date no significant disturbance has been observed.

Ground Water Modelling - The goal of the groundwater modelling program is to develop and maintain mathematical modelling capability for ground water resources evaluation and protection. The general framework involves analysis and interpretation of hydrogeologic data and synthesis of results through modelling. The results assist water resource managers in planning water use and its protection, identify data gaps and provide a basis for designing monitoring programs.

Recent modelling efforts have been directed toward the development of ground water management models based on the joint use of flow simulation and optimization methods. A study to assess optimal ground water withdrawals from an aquifer in the Cold Lake area was completed. An optimization model is presently being used for analyzing the operation of pressure relief wells in the Cochrane aquifer which is hydraulically connected to the Waterton Reservoir.

Hydrology Branch

The Hydrology Branch is responsible for providing hydrological engineering analyses of the surface water resources of the province. This includes determination of annual and seasonal volumes of streamflow, the magnitude and frequency of extreme events such as floods and droughts and the provision of information and analyses for water management projects such as river basin planning, reservoir design and lake stabilization. The branch also assesses both the natural and human-altered environmental characteristics affecting streamflow.

During the year the branch handled 264 requests for service from other divisions and departments. Major studies were undertaken on a wide variety of subjects, such as: The Waterton Reservoir Probable Maximum Flood Study; The South Saskatchewan River Historical Natural Flow Study, 1983 to 1986 which provided an update to natural flows calculated for the 1912-1982 period; The Natural Yield Model which provided specific yield estimates for licenced watersheds using recorded hydrometric data within a watershed; The North Saskatchewan-Battle River Regional Hydrologic Study and the Red Deer River-Sounding Creek Regional Hydrologic Study; and the Oldman River above Lethbridge Historical Weekly Natural Flow Study, 1960 to 1986, which produced a set of weekly natural flows to assess instream flow needs on the Oldman River.

An assessment of the current water licensing situations in Sounding Creek, Highwood River, Ribstone Creek, Berry Creek and Nose Creek was completed. Maps outlining withdrawal locations and drainage areas for approximately 800 water licences and hydrology reports presenting the expected volume of water available for use at each licenced location, were prepared.

River Forecast Centre

The River Forecast Centre monitors river streamflow conditions and provides flood forecasts for disaster prevention and flood damage reduction. It also produces water supply forecasts to enable management of the water resources of the province.

Streamflow Monitoring and Forecasting

The centre continuously monitored weather, snowpack and streamflow conditions throughout the province in order to prepare flood and water supply forecasts and to advise a variety of agencies on changes in river levels.

Impending flood situations resulting from rainfall or melting snow were detected and analyzed. When necessary, the centre issued warnings of expected high river levels to a variety of agencies responsible for flood damage prevention and flood event analysis. These agencies include local municipalities and private companies as well as provincial and federal government organizations.

The only major river flood which occurred during the summer of 1987 was one which affected the Simonette, Smoky and Peace Rivers in the Grande Prairie-Peace River area. Heavy rainfall associated with the same weather system which created the Edmonton tornado at the end of July produced record flood levels along the Simonette River. This flood threatened the town of Peace River as well but the warnings provided by the River Forecast Centre enabled preventive measures to be taken and no major damage occurred in the town.

Information was provided to a number of communities which discharged sewage effluent into various rivers. On occasion, the centre also provided streamflow information to construction firms working in the floodplain of a river.

The centre monitored streamflow conditions at Alberta's borders and advised the department's water managers regarding impending difficulties. This helped the province satisfy the terms of interprovincial and international agreements.

Weekly river reports on current streamflow conditions and expected trends for many of the most important streams in Alberta were produced and disseminated to a variety of interested agencies, both in government and in the private sector. In addition, the centre provided a public information service for canoeists and other recreational interests through an automatic telephone answering service.

Water Supply Forecasting

The centre produced and distributed the Spring Runoff Outlook report in cooperation with the Survey Branch. This report, issued in early February, March and April, describes the water supply and flood potential outlook from spring snowmelt for the plains areas of Alberta.

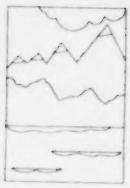
Similarly, the Water Supply Outlook for Southern and Central Alberta report was produced on a monthly basis from March to August. Annual summary reports were also published.

The spring runoff season of 1987 was one of early and below normal snowmelt runoff in southern and central Alberta and above normal runoff in northern Alberta.

Water supply conditions in southern and central Alberta during the summer of 1987 were generally below normal. The first half of the summer was very dry and the latter half was wet. The autumn of 1987 and winter of 1987/88 were dry and mild, producing conditions which indicated that 1988 would be another year of low water supply for central and southern Alberta.

Climatic Network and Data Acquisition

The centre made extensive use of data from Alberta Environment's real-time hydrometeorological network. These data have proven to be extremely valuable for flood and water supply forecasting. The centre continued its planning for the gradual expansion of this network into other areas where the present database is inadequate.



DEVELOPMENT AND OPERATIONS DIVISION

The Development and Operations Division was formed by the amalgamation of the previous Operation and Maintenance Division and the Design and Construction Division during 1987. The new division provides services that range from investigation and design to operation and maintenance of water resources projects throughout the province. Engineering services are provided by the Design, Geotechnical and Construction Branches. Operation and maintenance of water resource projects are the responsibility of the Projects Management and Irrigation Headworks Branches. Administrative support, supply and maintenance of equipment and operation of the revolving fund is the responsibility of the Equipment Supplies and Services Branch. Management of the Irrigation Headworks rehabilitation program is provided by the Director's office.

Design Branch

The branch is responsible for the hydraulic and structural design and drafting of water control and conveyance projects. The branch, in coordination with the Geotechnical Branch and with input from the Technical Services Division, prepares preliminary engineering designs, reports and detailed project designs, construction contract documents and cost estimates. The branch does engineering designs and technical reviews of water-related projects for other divisions and departments. The branch also provides photographic and drafting services to the department.

On major projects, Design Branch staff perform project manager roles. Some of the key projects phased for construction over more than one fiscal year are:

Lethbridge Northern Main Headworks System:

This project involved the rehabilitation and expansion of about 80 kilometres of irrigation main canal and associated structures, improvements to the diversion headworks and raising of Keho Lake. The construction work on this multi-year project was initiated in 1978/79 and by March 31, 1988 the rehabilitation of the entire headworks system was essentially complete, one year ahead of schedule. Reclamation of borrow areas, remedial and cleanup work and some outstanding land settlements remained to be completed. The upgraded canal was able to convey the increased capacity which greatly improved the water supply situation to the district this year. Total expenditure on the project is $121.0 million, including the cost of land acquisition, engineering and administration.

United Irrigation District Rehabilitation:

The Design Branch completed a Level I study for the rehabilitation of the UID main canal system. For this study, the district's 38,000 acres of potential irrigation development would be supplied with water from the Belly and Waterton River systems. The 15 kilometre main canal system, extending from the Belly River to Cochrane Lake, requires upgrading in order to have a capacity of 5.66 cubic metres per second. Total estimated cost for the UID main canal rehabilitation is $8.5 million.

Waterton-St. Mary Headworks System:

The Design Branch prepared contract documents for a cast-in-situ concrete, single barrel syphon to replace the existing deteriorated twin barrel wood stave syphon. The concrete syphon, which is 5.715 metres in diameter and 390 metres long, will convey irrigation water across Pinepound Coulee at a maximum discharge of 90.6 cubic metres per second (3200 cfs). The project was tendered and awarded at a cost of $4,085,000 and is scheduled to be completed by November 30, 1988.

Hutch Lake Dam:

This multi use project, located northwest of High Level, involves construction of a 10 metre high dam. The project is to be constructed over a three year period with the first phase of construction having begun in September 1987. The first phase of the project included embankment foundation preparation and reservoir clearing, at a cost of approximately $750,000. The estimated total cost for the project is $3.5 million.

South Heart Dam No. 1 New Spillway:

This project, located in the Peace River region, is designed to increase the storage capacity of the South Heart reservoir, to replace the existing deteriorated spillway and to increase the level of safety of the dam against overtopping. The proposed

structure is a special type of weir, known as a labyrinth weir spillway. The labyrinth weir crest is much longer than the chute width and therefore provides a larger discharge capacity than a normal weir crest. The recent completion of a hydraulic model study has determined the final geometry of the new spillway. The project is estimated to cost $2.5 million.

LaCrete Drainage:

Design was prepared for nine gabion type grade (erosion) control structures up to a height of five metres, on the Bear River, some 35 kilometres southwest of Fort Vermilion. The structures are intended to arrest severe river bed and bank erosion within this rich agricultural area. During the initial phase, five of the nine structures were built at a total tendered amount of $650,000.

Oldman River Dam Project:

Construction of the Oldman River Dam Project, approximately 10 kilometres northeast of Pincher Creek, proceeded on schedule during 1987-88 with the awarding of a $97 million contract for the main embankment. Contracts were also awarded for the drainage tunnels, dyke, public viewpoint access road, spillway access road and a road embankment. A report outlining the necessary transportation system modifications, the impact on utility systems and the reservoir clearing aspects of the project was finalized. A historical resources impact assessment, a palaeontological assessment and land irrigability classification reports were completed and released. Work continued on identification of new recreation/tourism opportunities with actual wildlife and fisheries mitigation work underway in the spring and fall of 1987.

Drafting Pool:

The drafting pool, with offices located in Edmonton, Lethbridge, Peace River and Calgary, provides diversified drafting services to the department.

The Structural Drafting Section prepared preliminary and detailed drawings, for various water resources related projects, such as dams, spillways, syphons, check and grade control structures.

The Survey Drafting Section prepared survey drawings for water resources management projects, maps for dam breach inundation studies, mosaics, various plates for reports and displays for meetings.

The General Drafting Section provides drafting services for the department. This included preparation of numerous displays and other art graphics for the Alberta Environmental Centre and the Communications Branch. Drawings for the compilation of the Environmental Handbook for Pipeline Construction, were prepared for the Land Reclamation Division. Ongoing projects include the Hydrogeologic Cross Sections of Alberta and the Atlas of Alberta Lakes.

Geotechnical Branch

The Geotechnical Branch provides geotechnical engineering services for departmental projects including geological engineering and geotechnical investigations, assessments and designs.

The branch prepares preliminary design reports, detailed designs, contract documents and cost estimates for division projects, along with geotechnical engineering and technical reviews for other divisions, departments and agencies. Through the Land Services Section, the branch negotiates land use agreements, carries out land appraisals and administers crown lands of interest to the department.

Geotechnical Design Section:

The section produces preliminary and final geotechnical designs and contract drawings for departmental water resource projects. During the past year, the section completed a total of 13 preliminary and 12 final geotechnical designs for a variety of projects such as the rehabilitation of existing irrigation headworks systems, recreation dams, flood protection dyking, erosion control structures, boat launches and slope stabilization. The section also performed 43 geotechnical reviews for other divisions. These reviews included assessments of water supply pipeline routes, mine tailing disposal sites, river bank stabilization and subdivision development proposals.

Geotechnical Services Section:

This section provides for site investigations, airphoto interpretation, material testing and managing geotechnical consulting contracts for branch projects.

Investigation Unit:

This unit carries out site reconnaissance, drilling and field testing, installs instrumentation and monitors water resources projects. Geotechnical investigations were completed for 22 projects during the reporting period. Drilling, instrument installation and monitoring were also done on seven projects for the Geotechnical Branch, other branches and for consultants doing studies for the department. The unit maintains an

inventory of gravel, sand and rock for projects throughout the province. Granular searches were completed for five projects.

Materials Testing Unit:

This unit tests soil and does quality control inspections during construction. The laboratory completed work on 22 projects and provided quality control services on four projects. Field laboratories were maintained at the Lethbridge Northern main canal rehabilitation and at Forty Mile Coulee projects.

Land Services Section:

This section is responsible for land use agreements, processing damage claims, representation of the department at Land Compensation Board Hearings, initiation of land acquisitions and land budget requirements. This section appraises land related to reclamation projects. The Land Services Section maintains files on all Crown land titled to Alberta Environment and administers leases and easements related to these lands. This section also maintains a library of Land Compensation Board decisions and court cases.

Construction Branch

The branch manages construction and administers construction contracts for water management projects. In 1987/88 the branch worked on 32 projects involving an expenditure of $14.5 million. Branch staff are also involved with multi disciplinary implementation teams developed for the implementation of major water management projects such as: the Pinepound Coulee syphon replacement with a 1987/88 expenditure of $864,000; the Hutch Lake Stabilization Project which cost $553,000 during the reporting period; and the Freeman River Flood Control project which involves removal of debris and obstructions along the main river channel and an associated stream and reconstruction of existing dykes. The works improve the channel capacity and reduce flooding and erosion to adjacent agricultural land. A two year project estimated to cost $150,000 and to be completed in the fall of 1988, the 1987-88 cost was $74,000.

Projects Management Branch

The branch operates and maintains provincially owned and cost shared non irrigation water management projects. These projects provide flood control, water conservation, streamflow regulation, lake stabilization, recreation, wildlife habitat and water supplies for many centres.

The central sector's flood damage repair work resulting from the 1986 flood, extended well into the 1987/88 fiscal year, with repairs being undertaken to dykes, culvert crossings and flap gates. Boat docks which had been preconstructed in Edmonton and trucked via ice bridges across Athabasca Lake were installed at Fort Chipewyan. Major erosion repairs and riprapping (gabion baskets) were carried out at Bearberry Creek.

The southern sector undertook river bank armouring at the Fort Macleod dykes on the Oldman River. Maintenance of control gates and trash racks, fencing and canal banks on the Little Bow canal and the installation of a seepage blanket at Squaw Coulee dam was undertaken. Service road repairs and maintenance of access roads at Bare Creek, Michelle, Reesor, McKay, McAlpine and Cypress View reservoirs were carried out. Water diverted or released to assist users with their water requirements totalled 62.3 million cubic metres.

Major maintenance in the Peace River and Grande Prairie sectors included the repair of some 30 kilometres of the Winagami-Girouxville canal which involved embankment, drop structure and culvert repairs.

Improvements were made to 16 kilometres of drainage channel under the Northern Alberta Erosion Control Program. Activities included brush removal and disposal, channel regrading, installation of grade control structures and seeding of disturbed areas.

Staff completed their fifth year of operation and maintenance of the Dickson Dam. Higher than normal inflows kept the reservoir high this year. Due to gradual snowmelt no major peak inflows were encountered. Inflows throughout the summer were close to or below the mean year averages.

Lake stabilization projects operated by the branch include Gull Lake, located 12.9 kilometres west of Lacombe, and Lac Ste. Cyr, located 19.3 kilometres southeast of St. Paul. Both lakes are used extensively for recreation such as boating and swimming. Due to high lake levels in Gull Lake, pumping was not required during 1987/88. Some 1.06 million cubic metres of water were pumped into Lac Ste. Cyr from October 1987 to February 1988. The lake level increased by 0.45 metres to an elevation of 644.803 metres.

The branch administers the Emergency Water Supply Program which assists with pumping of water for communities experiencing municipal water supply problems. Seven communities were assisted with emergency pumping in 1987/88. These included the town of Fairview, the settlements of Big Prairie Metis, Little Buffalo and Loon Lake, and the villages of Kinuso, Canyon Creek and Rycroft.

The Deadfish/Sheerness Water Supply System is located south of the town of Hanna and north of the Red Deer River in the Special Areas. The Deadfish/Sheerness system is a

pumped diversion scheme on the Red Deer River, utilizing pipelines, concrete canals and natural stream beds for conveyance of water to irrigation, domestic and municipal users. During 1987 the systems provided water for 2,500 hectares of irrigation in addition to supplying water for the town of Hanna, village of Cessford and many stockwater dams and dugouts.

Approximately 13.7 million cubic metres of water was diverted by this system from the Red Deer River. Alberta Power Limited was required to release blowdown water from the Sheerness Thermal Generating Station starting in 1987. Approximately 2.2 million cubic metres of blowdown water was released to the system. Maintenance activities during the year consisted of canal and dam erosion repairs and the removal and repairs of a pump unit.

Under the Site Development Program, designated areas at reservoirs and stabilized lakes that are being used as access points for water-based recreation are developed for day use by the general public. During 1987/88 upgrading and development was carried out at Gleniffer Lake/Dickson Dam, McGregor Reservoir, Lesser Slave Lake Outlet, Heart River Dams, Little Bow Reservoir, Travers Reservoir, Winagami Outlet, Michelle and Bullshead Reservoirs. Activities included landscaping, parking lot and boat launch construction, replacement of shelterbelt material, table and bollard installations.

Through this program 33 day use sites have been established for public use on 21 stabilized lakes and reservoirs throughout Alberta.

Equipment, Supplies and Service

The Equipment, Supplies and Services Branch provides support to Water Resources Management Services. The branch has several functions:

Equipment Section:

This section administers a fleet of approximately 600 units and provides a variety of equipment for Water Resources Management Services. The section: repaired ice damaged beach at Little Bow; hauled firewood and constructed restrooms at various comping sites; maintained roads and gravelled canal banks; constructed a parking lot, walking trails, dyke and boat ramps at Dickson Dam; participated in installation and removal of safety and trash booms and Carseland and Calgary; provided material and equipment for canal armouring on Waterton, St. Mary and Belly canals; assisted special projects in the mowing and watering of various sites in southern Alberta; repaired the lower end of the discharge syphon at Wyndham and Carseland Park to increase public safety; pumped water for Cessford and Milo; replaced gravel under Lee Creek syphon; and drove piles for boat docks at Waterton Dam.

Materials Section:

With warehouse and yard storage facilities in Edmonton, Lethbridge, Grande Prairie and Peace River, this section manages a materials inventory of approximately $0.25 million. Management includes the provision of ordering, recordkeeping, warehousing, material sales services and equipment leasing functions directly serving Water Resources Management Services. Receiving and storage services are also provided for all areas of the department as required.

Revolving Fund Accounts Section:

The accounts section monitors and processes payments to vendors, issues invoices, monitors revenue and expenses, reports to management on financial status and prepares and monitors the Revolving Fund Budget.

Central Vehicle Services:

The vehicle co-ordinator for Alberta Environment administers the vehicle pool for the department throughout the province. Approximately 350 vehicles such as 1/2 ton pickups, 3/4 ton pickups, suburbans, four wheel drive vehicles and crew cabs were issued this year on permanent, seasonal and short term basis.

Administrative Support Group:

The Administrative Support Group administers division activities related to personnel, finance, staff development and budget. The group also provided financial control for a number of revenue producing agreements involving the use of provincial water management projects.

Irrigation Headworks Branch

The branch operates and maintains irrigation headworks systems which supply water for multipurpose uses including water for eight irrigation districts in southern Alberta: St. Mary River (SMRID); Lethbridge Northern (LNID); Bow River (BRID); Western (WID); Mountain View, Leavitt and Aetna (MVID, LID, AID); and Magrath (MID). Two other irrigation districts, Raymond (RID) and Taber (TID), are served by the SMRID. Some 352,000 hectares (870,000

acres) of assessed irrigation land benefited from water diverted by the following five provincially owned irrigation headworks systems: Waterton/St. Mary; Carseland/Bow; Western; Lethbridge Northern; and Mountain View, Leavitt and Aetna.

The province does not operate or maintain the headworks systems of the Eastern (EID), United (UID) and Ross Creek (RCID) irrigation districts. Under agreements between the province and the UID and RCID, funding was provided for urgently needed rehabilitation to keep the headworks systems operational. The agreement with the UID expired March 31, 1986 and the agreement with the RCID expired March 31, 1987. The federal government, under terms of a 1973 federal/provincial agreement, has completed the rehabilitation of the Bassano dam in the EID.

Work on the LNID headworks system included several surface drainage improvements complete with drain inlet structure. Slope stability problems were rectified at high groundwater locations with relief valves and slope rebuilding. A low level crossing was constructed on Kyiskap Creek and several other bridges were completed. Structure improvements included electrical grounding, expansion joint repairs and the placement of riprap armour protection for structure turbulence and wave action. A parking facility at the Keho boat launch was also constructed.

Maintenance and rehabilitation work on the Waterton/St. Mary system included minor bridge and syphon repairs and extensive riprapping below major structures and gravel armouring and resloping of approximately 32 kilometres of main canal. Upgrading was done to the St. Mary spillway stoplog machine and a new water supply line was installed to service the St. Mary camp.

On the Western headworks system, continued emphasis was placed on making the public aware of the dangers at the weir on the Bow River in Calgary and debris cleanup along the canal required considerable effort.

The Carseland/Bow headworks system benefited from concrete repairs to the south McGregor outlet energy dissipator, chain link safety fence at Little Bow outlet, canal bank repairs and a replacement seepage pump at North McGregor dam. The West Arrowwood syphon also required extensive repair work.

Rehabilitation work on the Mountain View, Leavitt, Aetna headworks system included repairs to minor canal bank slides, replacement of an underdrain, silt removal from 16 kilometres of canal, slope and spillway upgrading at East Payne dam and installation of chain link safety fence on a dangerous structure.

The branch transferred its headquarters to Lethbridge and all field operations and office administration are now at that location. Staff are also located in Calgary, the Oldman River dam, the St. Mary dam, Fort Macleod and Arrowwood.

Table 10 shows the headworks system delivered 1.4 million dam3 (1.14 million acre feet) of water to the irrigation districts in 1987.

WATER RESOURCES ADMINISTRATION DIVISION

The division is comprised of the office of the Director, four branches and five regional offices. Under the authority of the Water Resources Act, the Water Resources Regulations, Provincial Water Power Regulations, the Dam and Canal Safety Regulations and the Drainage Districts Act, the division is responsible for administering and enforcing the water resources legislation, regulations, policies and programs such as the Alberta Water Management and Erosion Control Program which provides financial assistance to local authorities. Services are extended to the general public, local authorities, industry, other government departments and divisions within the department.

Water Rights

The Surface Water Rights Branch and the Ground Water Rights Branch process applications under the Water Resources Act for licences to divert and use surface water and ground water. Terms and conditions for the licences are prepared through liaison with other agencies and input from private individuals or groups. Files and plans are maintained for all projects and the quantity of water consumed is monitored by field inspections and water-use return forms.

Surface Water Rights Branch

The progress report of the Surface Water Rights Branch (see tables 11 and 12) shows that while the total number of applications dropped this year, most of the decrease was in the small agricultural stockwatering category. Applications for irrigation and storage projects are still being received at a comparatively high rate.

The moratoria on processing of licence applications in the Willow Creek, Highwood River, Little Bow River and Milk River Basins were retained throughout 1987-88, except for small domestic, stockwatering and necessary municipal purposes.

Staff continued to provide input to water management studies for the Pekisko-Stimson and Kneehills Creek basins through the technical advisory committee.

Water use information was collected for the Lodge, Battle and Middle Creek Basins and was provided to Water Survey of Canada (WSC) in conjunction with the interprovincial and international commitments for these basins. Water use information was also collected for the Many Island Lake Basin and provided to the Prairie Provinces Water Board (PPWB). This basin is managed jointly by Alberta and Saskatchewan and the PPWB was able to update their records for all projects in the Many Island Lake Basin.

Considerable staff time was spent in various stages of the approvals required for the Oldman River Dam.

Hydro-Electric Section:

The Hydro-Electric Section is responsible for administration of the Provincial Water Power Regulations under the Water Resources Act.

Field inspections were conducted to monitor progress at hydro-power maintenance projects, to ensure compliance with licences and regulations and to observe various sites in relation to disposition applications. During 1987-88 TransAlta Utilities completed improvement works on the Rundle spillway channel (Canmore Creek) as well as maintenance projects on other developments. Modifications to improve the probable maximum flood (PMF) capabilities at the Bearspaw, Ghost Diversion and Cascade Developments were completed. PMF modifications are continuing at the Ghost Development.

There was increased public interest in the development of small hydro-electric facilities at various sites within the province, particularly the Dickson Dam.

Net hydro-electric generation in the province for the past five years is illustrated in Table 13.

Ground Water Rights Branch

The Ground Water Rights Branch progress report, Table 14 shows an increase in the number of applications for licences and temporary permits of approximately 36 per cent from the previous year. The number of interim and final licences issued decreased by 17 and eight per cent respectively. The number of exploration permits issued decreased by 22 per cent.

The total number of field inspections declined over the previous year. Of the 131 inspections, 88 were carried out under Section 33 of the Water Resources Act and 43 were either complaint investigations or inspections made to obtain information regarding applications for exploration permits or licences. Table 15 outlines ground water rights in good standing at fiscal year end.

Dam Safety Branch

The Dam Safety Branch reviews designs for dams on referral from the Controller of Water Resources and monitors the safety of existing dams. The branch operates under the authority of the Dam and Canal Safety Regulation which applies to dams that are at least eight metres high or have a reservoir capacity of at least 62,000 cubic metres. In 1987, about 1300 dams met these criteria.

The branch reviewed designs submitted for approximately 40 water rights licence applications. Several reports were also reviewed including dam safety reports on Waterton, St. Mary, Pothole, North and East Ridge, North and South McGregor and Payne Lake dams and reports on the ongoing construction of the tailings ponds for Suncor and Syncrude tar sands plants.

A major part of the branch's work is inspections and instrumentation. In 1987, 348 dams were inspected at locations ranging from the Cypress Hills to Fort McMurray. Instrumentation was installed at Paddle River, Dickson, North Ridge and Payne Lake Dams and instrumentation was read at several projects including Dickson and Paddle River dams and the major irrigation headworks dams. A performance report was prepared for the Dickson Dam based on instrumentation readings and inspections by Dam Safety staff. Work continued on computer programs for reducing and plotting instrumentation data.

Dam breach analyses were carried out on the Sherburne dam in Montana and the Oldman River Dam Cofferdam. Emergency preparedness plans for both these developments and the Dickson Dam have been prepared and are being reviewed by interested parties.

Administrative Support Branch

This branch is repsonsible for the overall budget, financial management, personnel administration, purchasing, accounts payable, inventory control, records management control and consultant contract administration for the division. It provides administrative and advisory support to the nine drainage districts in Alberta and coordinates requests for flood analyses and the appraisal of damage claims for Alberta Public Safety Services.

Financial Administration Section:

This section is responsible for the preparation of the yearly divisional budget, monthly budget forecasts, purchasing, accounts payable, personnel administration, payroll, contract administration, inventory control of fixed assets including EDP hardware and software and forms. It also coordinates accommodation, parking, vehicle rental and office automation for the division.

Records Administration Section:

This section is responsible for the creation, maintenance, retrieval, control and disposition of records. These records pertain to the management and licensing of water resources in the province. They are used mainly by the Water Rights Branch and Regional Services Branch in the administration of the Water Resources Act and the Ground Water Development Act. Drainage district records which are used by the Drainage Council are also

maintained in this section. Records are stored in three main media, paper, microfilm and computer. The Water Rights Branch provides the computer data. Table 17 illustrates the work performed and a comparison of increase/decrease over the previous two years.

Alberta Public Safety Services:

The branch head, as a member of the Disaster Assistance Committee, was involved with Alberta Public Safety Services in coordinating the evaluation of 11 storm and flood events. In addition, 46 flood related appraisal requests were investigated on behalf of Alberta Public Safety Services.

Regional Services Branch

The Regional Services Branch provides services to the general public by administering and enforcing the Water Resources Act; supplies financial assistance to local governments, technical assistance for farm water management projects to landowners and inspects water related problems for the public.

The branch has five offices in Peace River, Edmonton, Red Deer, Calgary and Lethbridge. These offices are responsible for authorizing non-consumptive water use as required by the Water Resources Act and undertake inspections for the Water Rights Branch to assist in issuing consumptive water use licences. In addition, letters of authority, authorizing temporary withdrawals of water are issued at the regional level. Regional offices are also responsible for investigating violations of the Water Resources Act and for initiating court action when necessary.

Financial assistance is provided to local governments under the Alberta Water Management and Erosion Control Program. The department contributes 75 percent of engineering and construction costs. In cases where drainage projects improve agricultural land or agricultural production, 86 percent of construction and engineering costs are provided.

Projects eligible for assistance include flood and erosion control, drainage, flow regulation, water-based recreation, wildlife enhancement, source of water supply and water management overview studies.

Under the Farm Water Management Program, technical assistance is provided to landowners who wish to construct a water management project. This assistance includes survey and design services.

Table 16 summarizes regional activities for the year.

Peace River Region

A normal spring runoff occurred this year with the exception of the Ft. Vermilion/LaCrete area. Runoff in the Ft. Vermilion/LaCrete area was estimated to be near the 1:10 spring event. Severe rainfall from the weather pattern which caused the tornado that struck Edmonton affected the area south and east of Reno, the Keg River area and the area 20 km south of LaCrete. Crops in a 65 square km area were hailed out near Reno. The flooding resulted in Alberta Public Safety

Services initiating a flood recovery program for the Reno/ Keg River areas.

A total of 274 inspection requests were received. There were 270 inspections conducted and 248 technical reports processed.

The Farm Surface Water Management Program accounted for 64 of the inspections received and water rights accounted for 50.

A total of 26 licences were issued for non-consumptive water use projects. There were 153 permits and 34 letters of authority issued.

There were 16 projects constructed or commenced under the Alberta Water Management and Erosion Control Program.

Edmonton Region

Most of the Edmonton Region received below normal precipitation for the period October 1, 1987 to March 31, 1988. The city of Edmonton and immediate area received only 44 per cent of normal precipitation. Only the extreme northeast area of the region (Fort Chipewan) received normal precipitation.

The Edmonton Region received 426 inspection requests on water control and water management problems; 82 requests were related to alleged violations under the Water Resources Act. During the 1987-88 fiscal year, 450 field inspections were completed. In addition, the region conducted 73 appraisals under the 1986 Flood Recovery Program on behalf of Alberta Public Safety Services.

The Edmonton Region received 75 licence applications and 254 permit applications. A total of 66 interim licences, 53 licences, 247 permits and 66 letters of authority were issued. Three licence applications were cancelled.

A total of 35 projects were funded with local authorities under the Alberta Water Management and Erosion Control Program. In addition three projects were totally funded by the province.

There were 22 new requests under the Farm Surface Water Management Program, 23 surveys and 12 designs were completed. Construction was undertaken on 11 projects. A total of eight interim licences and 12 licences were granted for Farm Surface Water Management Projects. In addition, 72 Farm Development and Reclamation referrals and Soil Conservation Project referrals (Alberta Agriculture) were reviewed. Inspections were carried out on 10 referrals.

The region prepared one court brief related to violations under the Water Resources Act and was involved in three prosecutions.

Red Deer Region

The region experienced dry weather conditions throughout the year and snowfall during the winter of 1986-87 was minimal throughout the region. A major snowstorm occurred on April 18 and 19, 1987. However, the run-off from this storm and from the winter snow was minimal. Spring and summer conditions were average and fall conditions were extremely dry with minimal snowfall occurring in the fall and winter of 1987/88.

The region received 305 new inspection requests along with 63 outstanding requests from the previous year.

A total of 40 requests for assistance under the Farm Surface Water Management Program were received with 32 new projects underway. There were 27 surveyed, 25 drafted and 19 designed. Construction was undertaken on three projects.

A total of 62 Farm Surface Water Management projects were under investigation at the end of the year.

Regional staff received 146 new permit applications, 13 licence applications and 15 requests for temporary authorizations for water withdrawal. The region issued 143 permits, 13 licences and 15 temporary authorizations

A total of 19 projects were funded in the region. Two projects were totally funded by the province, the remainder were funded with the local authorities under the Alberta Water Management and Erosion Control Program.

In general, inspection requests increased 20 percent, regulating functions increased 11 percent, Farm Surface Water

Management Project requests increased 18 percent and Alberta Water Management and Erosion Control Program requests increased 63 percent over the previous year.

Calgary Region

The dry weather experienced during most of the winter period of 1986/87 continued. May and June precipitation was much below normal for all of southern and central Alberta.

The very dry conditions continued until mid-July after which several major rainstorms occurred. August continued the trend of cool, unsettled and wetter than normal weather. In September and October, the weather turned warm, dry and sunny. The southern two-thirds of the province was extremely dry with most locations receiving less than 10 mm of precipitation and very little snow had started to accumulate in the mountains by the end of October. The winter of 1987/88 continued to be extremely dry and drought warnings were issued in January.

During the year, 33 projects were under review for financial assistance under the Alberta Water Management and Erosion Control Program. Construction work was completed on eight projects.

The Calgary Region issued 94 permits and three licences for non-consumptive water use projects under the Water Resources Act.

A total of 167 inspections were completed for consumptive use water projects, non-consumptive use water projects, enforcement under the Water Resources Act and complaints related to surface water.

One request was received and five designs were prepared, under the Farm Surface Water Management Program.

Lethbridge Region

The year started with little moisture reserves in the soil and minimal snow cover in the mountains. Crop yields on dryland varied widely throughout the region reflecting the intermittent pattern of rain or showers.

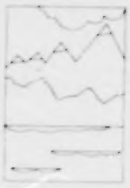
Watermastering started early on irrigated land and was maintained throughout the summer. Winter temperatures were above normal and no significant snow packs accummulated in the mountains.

Although the autumn of 1987 brought some relief of water shortages, below normal snow falls indicated drought conditions would continue. The farming community is seeking to secure reliable water supplies for livestock and crops from surface and ground water sources. With such strong demands on water supplies, the office watermastering function is now firmly established.

Inspection activities remained steady from previous years with a significant reduction of the backlog. Requests received for the year totalled 283 and a total of 315 inspections were undertaken. The Farm Surface Water Management program accounted for 26 requests and the office provided 19 reports to applicants. In addition, regional staff processed 32 referrals from Alberta Agriculture dealing with similar on farm water management concepts.

The region received 63 applications for permits and 11 for non-consumptive water use licences. The office issued 58 permits and 10 licences over the same period. A total of 20 letters of authority were issued during this report period.

Seven projects were constructed under the Alberta Water Management and Erosion Control Program.



PLANNING DIVISION

River Basin Planning

River basin plans deal with the water resources of a basin as a system. Basin studies cover water supplies and demands, environmental needs, water resource conflicts and other water related factors. A basin plan recommends ways of meeting future needs, resolving allocation and environmental problems and provides guidance for the development of water resource projects. Plans are updated periodically to incorporate changing conditions.

Peace River Basin: Consultation and preparatory work for the water quality component of the Peace River Basin Planning Program was carried out. Work for calibrating the model to simulate flows on the Peace River was initiated. Major staff time was committed to the sub-basin water management planning component of the basin plan. This dealt with erosion, flooding, poor drainage and other issues such as land use practices and wildlife habitat loss.

Athabasca River Basin Planning Program: A detailed outline of the proposed Planning Program has been drafted. The purpose of the program is to develop a plan to achieve the protection, improvement and wise use of the water resources of the Athabasca River Basin.

Background studies on pollutant loadings were completed and new work began in the area of water quality modelling. The models will be used to assess the impacts of development in the basin on water quality in the river.

The development of water quality criteria was initiated and an aquatic fate and tailings pond research study outline was prepared. Work on effluent loading forecasts was initiated.

Studies were initiated in the urban flooding, recreation, drainage and wetlands and groundwater components of the planning program. These studies included an inventory of urban flood problems in the basin, an assessment of key recreational water bodies, a review of available ground water information and an inventory of drainage-related complaints in the basin.

North Saskatchewan River Basin: A comprehensive analysis of current and future water use in the basin from 1986 to 2006 was initiated.

During the year priority was given to the mainstem water management component of the program. Studies of updated flow hydrology and updated water use and demand were completed. Scenario runs on the water balance model were carried out as well as initial calibrations of the stochastic water quality models for dissolved oxygen and nutrient parameters in the Edmonton - Saskatchewan border reach. In addition, work was done on hydraulic parameters upstream of Edmonton, on design storm event hydrographs in Edmonton and on trace metal decay rate coefficients in the river.

In relation to the wetlands/drainage component of the program, an overview study of the wetland and riparian wildlife habitat was completed.

Cold Lake-Beaver River Basin: Implementation of the Cold Lake-Beaver River Long Term Water Management Plan continued. A summary report on the long term plan was completed. Studies continued on the formulation of guidelines for ground water management and subsurface disposal. The review of water recycling guidelines for wastewater from in situ oil sands plants continued with the oil industry and the Energy Resources Conservation Board.

South Saskatchewan River Basin: The Alberta Water Resources Commission completed its review of basin water management alternatives and released its findings in the publication Water Management in the South Saskatchewan River Basin, Report and Recommendations. Water management policy and strategies to guide future planning activities in the basin are being developed.

Regional Water Resource Planning

Similar in scope to river basin planning, this section deals with a small geographic area, usually a sub-basin.

Sub-Basin Water Management Studies: A balanced approach to agricultural drainage and the mitigation of loss of wildlife habitat was incorporated into planning for seven water management areas. The work forms the basis for the development of comprehensive water management plans which will include public and local authority input.

Willow Creek Basin: The Pine Coulee offstream storage project is in abeyance pending decisions by the government on funding and an implementation schedule. Previous studies have determined that the project is feasible on technical, economic, social and environmental grounds.

Buffalo Bay-Horse Lakes Management Plan: Previously identified management schemes to enhance the fisheries, agricultural and wildlife potential of the area were examined.

Little Bow River Basin: Storage development in the Little Bow River basin is in abeyance pending decisions by the government on funding and an implementation schedule. Previous studies have concluded that the project is feasible on technical, economic, social and environmental grounds. An integral component of the project is the rehabilitation of the Little Bow diversion headworks and canal. An environmental impact assessment, which will consolidate existing information in one document, is being prepared.

McLeod River Basin: Coal mining and forestry development forecasts were translated into assessments of potential runoff impacts on the water resources in the basin. Water balance modelling runs were undertaken incorporating these potential effects. Suspended sediment data were collected and compiled. Work was begun on a technical report on study methods and on a water balance model users' manual.

Pekisko and Stimson Creeks Basins: The draft report on the water management study for these tributaries of the Highwood River was completed. The study evaluated methods of managing water for irrigation, stockwatering, fishing and recreation.

Pembina River Basin: A study outline for a floodplain management study was drafted. The study is to evaluate the benefits and costs of various structural and non-structural alternatives aimed at reducing future flood damages in the Pembina River Valley. The study is to include collection and analysis of historical information, analysis of 1986 flood damages, preparation of flood risk maps and flood damage curves, analysis of cost versus benefits and formulation of a recommended approach after consultation with the general public and a specially formed committee.

Ross Creek Basin: A draft report dealing with water management issues was completed. The future water management implications of the report are under review.

Kneehills Creek Basin: The second phase of a water management program assessed the ability of current water supply to meet present and future demands and developed water management alternatives to solve problems. The impact of alternatives was identified and an overall water management plan and strategy for the basin were completed. A draft report has been prepared.

Etzikom Coulee: Investigation of water quality and supply problems along Etzikom Coulee continued. The primary focus was on Crow Indian Lake which is comprised of two Ducks Unlimited projects locally known as Kings Lake and Conrad Flats. The purpose of the study is to provide feasible water management alternatives to resolve problems experienced by existing users and provide for future uses, recognizing the limited water resource available.

Swan Lake: An assessment was undertaken of the potential for stabilization of the lake by the construction of an outlet control structure.

Keg River Drainage: A conceptual drainage system was developed and costed for about two and one-half townships of poorly drained land.

Kimiwan Lake Management Study: Activities undertaken for this ongoing study were: negotiations with landowners on an appropriate target water level and land use in the management area; and development of costs for an improved outlet.

South Heart-Winagami Operational Plan: A review of the management priorities and operational procedures was initiated for the reservoirs and structures in the South Heart-Girouxville Canal system.

Minnie Lake/village of Glendon Water Supply: This project was completed. The village of Glendon is now using ground water and is no longer withdrawing water from Minnie Lake. Minnie Lake water levels are being monitored.

Oldman River Dam Project: The branch coordinated the water quality component of the reservoir operations plan and continued supervision of a reservoir recreation concept planning program.

Milk River Project: Site-specific environmental studies focusing on fisheries, rare flora and fauna, water quality and historical resources were completed. Further environmental studies addressing the impact of increased irrigation on ground water and the Milk River were initiated. The exchange of technical information between Alberta and Montana continued.

Blood Indian Reserve: An economic analysis was undertaken of the direct benefits and costs of a proposed irrigation development in the Blood Indian Reserve.

Drumheller Flood Control: Implementation of flood control measures in the downtown Drumheller area continued. Various alternatives for flood control in East Coulee have been assessed.

Red Deer River Valley Irrigation: A study is being undertaken to examine the opportunity for expanded irrigation on land within the valley between Drumheller and the Saskatchewan border.

Elbow River Floodplain Management: A committee composed of members from Alberta Environment and the city of Calgary completed the preparation of a floodplain management plan for the the Elbow River within the city of Calgary.

Clear Lake: The Clear Lake Project consists of a diversion headgate and canal from Mosquito Creek to Clear Lake and is being considered for funding and implementation. Benefits

of this lake level enhancement project would be in the form of enhanced habitat for fish and wildlife as well as for recreation and livestock watering.

Rocky Mountain House Winter Floodplain Monitoring Committee: Due to mild winter conditions, the committee did not have cause to report any specific local flooding problems related to flow fluctuation and winter ice packing downstream of the Bighorn hydropower plant on the North Saskatchewan River.

Fort McMurray Floodplain Management Study: The proposed flood protection dyke for the city of Fort McMurray is awaiting negotiation of a cost-sharing agreement with the federal government. These negotiations will begin when the Flood Damage Reduction Agreement between Canada and Alberta is signed.

Environmental Mitigation Planning

This step in the planning process is carried out at the project implementation stage. The intention is to identify opportunities for environmental enhancement stemming from the construction of water resource management works and to ensure that adverse environmental effects are properly mitigated during and after construction.

Oldman River Dam Project: Environmental mitigation planning continued on wildlife, fisheries, vegetation, historical resources and recreation components.

Hutch Lake Project: A pike spawning mitigation plan was developed and a feasibility analysis of a subimpoundment was initiated.

United Irrigation District Headworks/Cochrane Lake:

Environmental mitigation studies were continued. Environmental planning input from other departments was coordinated.

Forty Mile Coulee: An environmental mitigation report was completed.

Data Base and Methodology Development

The effectiveness of the Planning Division is enhanced by the compilation and updating of water resource data such as water supply and demand. As well, new analytical and predictive methods can improve the capability in water quality planning.

Water Use Information System: This data base provides water withdrawal and consumption statistics for agriculture, municipal, industrial, enhanced oil recovery and water power use sectors. Entry of historical data continued and output from the system was provided to other divisions, consultants, oil companies and other agencies.

Industrial Water Use Survey 1986: This survey is part of ongoing program whereby data is collected every five years. A questionnaire was administered to 569 industrial water users in Alberta. The collected data will be used in the preparation of a report on provincial industrial withdrawals, discharges and consumption. Aggregated data will be presented by industrial sector and by river basin.

Other Planning Services

Regional Lake Overview: Work was undertaken to develop a process whereby a warning system could be established to identify lakes in the region which could receive development pressures so the department can prepare to respond in a proactive manner.

Report Design: Several base maps, display and other visual materials were prepared in conjunction with river basin planning program projects. Planning Division reports were reproduced and assembled. A Water at Work exhibit was revised and was displayed at several locations around the province. The branch coordinated and produced Oldman River Dam project display materials for use at information meetings and public advisory committee workshops.

Municipal Water Demand Studies: Water demand forecasts for several municipalities were prepared for use in basin planning studies or to assist in establishing water licensing requirements.

Regional Water Demand Studies: Water demand studies were completed for tributaries for the Milk River in the Sweetgrass Hills area and for the Sylvan Lake area. As well a survey was sent to oil companies in the Cold Lake - Beaver River Basin and a draft report was written concerning future water demands for in situ oil recovery projects.

Environmental Impact Assessment Review: Environmental impact assessments submitted to the department for proposed provincial industrial and water resource developments were reviewed from a water resources perspective.

A review process identified several water resource management concerns regarding Crown lands and these concerns were directed to Alberta Energy's Mineral Resources Division.

Resource Integration Committee: This committee provides interdepartmental input to public land use planning in Alberta. The branch assisted this committee by providing departmental liaison with Alberta Forestry, Lands and Wildlife.

Policy Documents: Water resource management issues were reviewed in the Alberta Private Campground Association Industry Analysis Report and an Alberta Recreation and Parks policy document.

Regional Planning: Regional planning concerns regarding water resources were addressed in reviews and final preparation of the Big Lake Area Structure Plan and the County of Strathcona Outdoor Recreation Master Plan. As well, experimental lime treatment to Figure Eight Lake was undertaken.

MacKenzie River Basin Committee: Division staff participated in the collection of background data in support of transboundary water management agreements between Alberta, British Columbia, the Northwest Territories and Saskatchewan. Technical discussions with the Northwest Territories have resulted in a proposal for expanded water quality monitoring at the border. Similar discussions are underway with Saskatchewan and are being initiated with British Columbia.

STATISTICAL TABLES

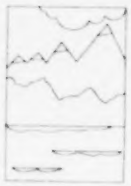


TABLE 1
Positions by Category

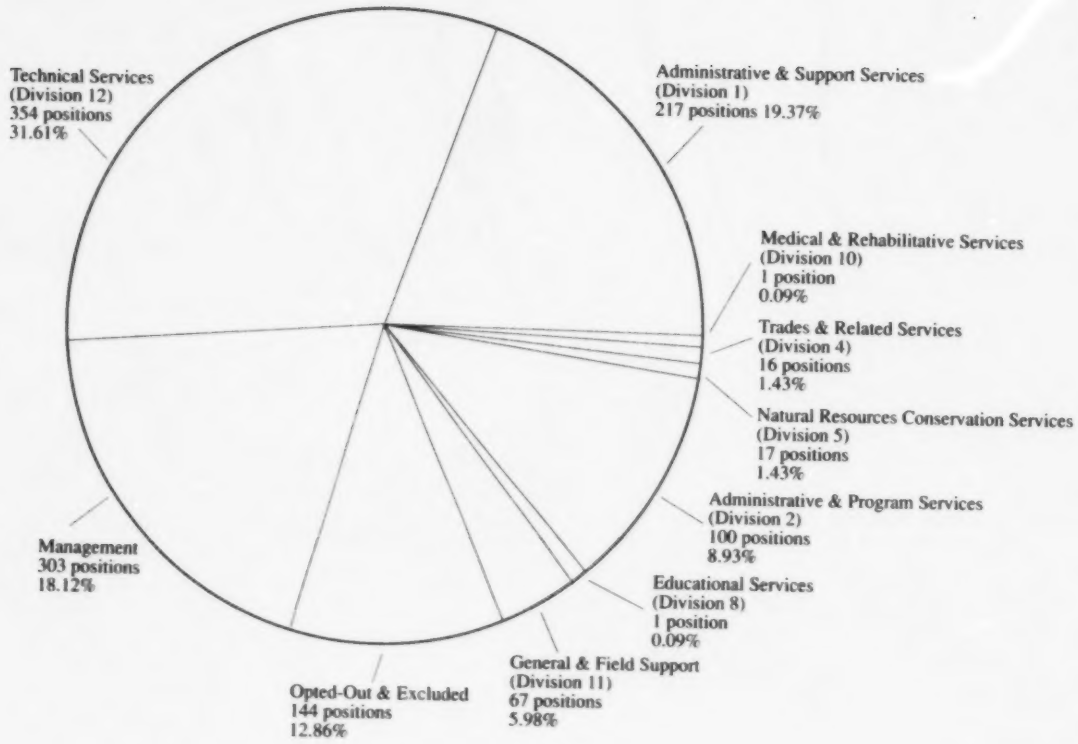


TABLE 2
Employee Locations

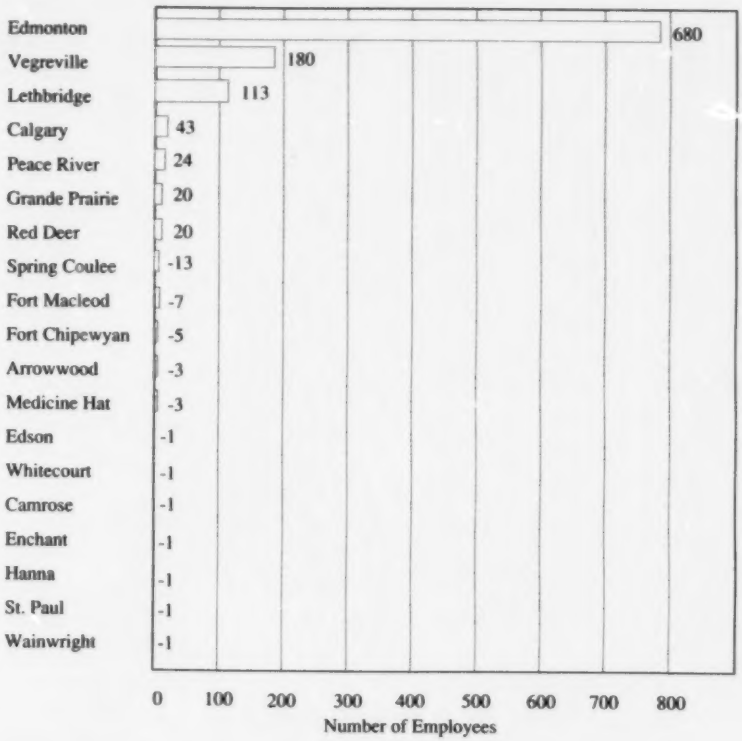


TABLE 3
Employee Distributions

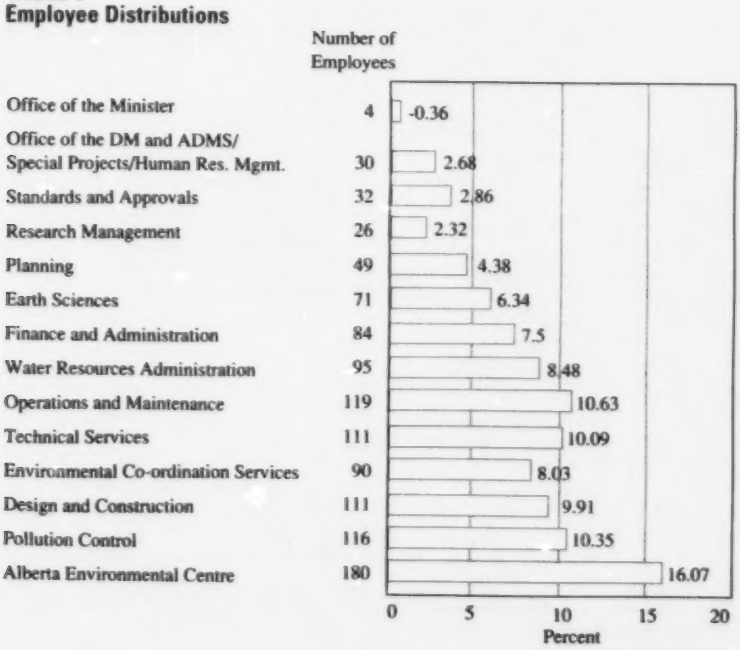


TABLE 4
Complaints Investigated by Air Quality Control Branch

Type of Complaint	Urban area		Rural area		Total
	Edmonton	Calgary	North	South	
Odor	198	205	198	78	679
Dust	66	56	110	57	289
Smoke	75	53	92	27	247
Noise	8	0	15	1	24
Misc.	16	12	38	19	85
Total	363	326	453	182	1,324

TABLE 5
Reports reviewed per year as required by clean air licences

	1983	1984	1985	1986	1987
*	3,525	3,538	3,561	3,487	3645
**	207	220	249	268	271

* Monthly reports required by licence.
** Annual reports required by licence.

TABLE 6
Field Services Section Activity Comparison

	1985-86	1986-87	1987-88
Inspections	1,134	1,064	1,250
Problem Investigation	53	110	106
Composite Sampling	60	67	118
Communities Inspected	400	413	494
Semi-Public Facilities Inspected	93	84	121

TABLE 7
Air Quality Permits and Licences

Category	Permits	Licences
Agricultural Activities Including Meat Processing Plants	4	36
Asphalt Plants	0	13
Chemical Plants	6	2
Compressor Stations	30	78
Experimental In-Situ Oil Sand Operations	7	8
Fertilizer Plants	1	4
Gas processing Plants	43	128
Incinerators	6	55
Oil Refinery Operations	0	3
Power Plants	0	2
Others	20	39
Subtotal	117	368
Amendments	7	136
Total	124	504

TABLE 8
Clean Water Act Approvals Issued

Category	Permits	Licences
Asphalt plants	0	10
Chemical plants	5	7
Coal processing	2	0
Concrete and cement	0	0
Fertilizer	1	1
Food processors	0	4
Gas plants	16	73
Meat packing and processing plants	0	2
Oil sands plants	6	9
Petroleum refineries	0	3
Power plants	0	3
Pulp mills	2	0
Salt caverns	2	1
Sand and gravel washing plants	0	17
Tar sands	1	0
Wood processing	0	4
Others	5	8
Subtotal	40	142
Amendments	3	61
Total	43	203

TABLE 9
Municipal Permits and Licences

Category	Permits	Licences
Water supply	110	96
Sewage treatment	59	45
Water and sewer extensions	102	—
Storm sewer systems	24	—
Total	295	141

Municipal Letters of Permission

Category	Letters
Land Application of sewage effluent or sludge	16
Special Treatment experiments	15
Other	7
Total	38

TABLE 10

Irrigation District	Water Dam³	Volume Ac.Ft.
St. Mary River (incl. TID and RID)	644,000	522,000
Bow River	339,000	275,000
Western	160,000	130,000
Lethbridge Northern	224,000	182,000
Mountain View, Leavit, Aetna	20,000	16,000
Magrath	15,000	12,000

TABLE 11
Surface Water Rights In Good Standing

	Dom.	Mun.	Irgtn.	Agr.	Ind.	Water Power	Other	Storage	Natural State	Dvrsn.	Total 87/88	Total 86/87
Applications	0	25	339	51	23	1	36	57	0	155	687	570
Interim Licences	0	36	386	137	22	1	35	94	0	554	1,265	1,251
Licences	0	297	2,127	6,374	346	8	102	608	1	933	10,796	10,468
Net Totals	0	358	2,852	6,562	391	10	173	759	1	1,642	12,748	12,289

Note: Statutory purpose domestic was changed to agricultural on June 8, 1984 for all surface water rights projects.

TABLE 12
Surface Water Rights Progress Report

	Dom.	Mun.	Irgtn.	Agr.	Ind.	Water Power	Other	Storage	Natural State	Dvrsn.	Total 87/88	Total 86/87
Applications Received	0	12	143	127	10	0	16	56	0	115	479	560
Interim Licences Issued	0	17	93	114	9	0	6	47	0	103	389	536
Interim Licences Re-issued	0	8	76	300	18	0	8	14	0	28	452	743
Licences Issued	0	17	66	100	12	0	6	38	0	107	346	444
Licences Re-issued	0	22	61	323	17	0	0	3	0	2	428	675
Permits Issued	0	165	0	0	350	0	174	0	0	0	689	581
Transfers	0	5	53	154	9	0	2	1	0	4	228	232
Cancellations	0	0	41	32	6	0	2	5	0	25	111	94

Note: Statutory purpose domestic was changed to agricultural on June 8, 1984 for all surface water rights projects.

TABLE 13

Year	Megawatt-Hours
1983	1,473,000
1984	1,420,000
1985	1,385,366
1986	1,821,670
1987	1,459,252

TABLE 14
Groundwater Rights Progress Report

	Dom.	Mun.	Irgtn.	Agr.	Ind.	Other	Dvrsn.	Storage	Total 87/88	Total 86/87	Total 85/86
Exploration Permits Issued	4	19	3	30	45	6	3	1	111	143	118
Applications Received	5	94	1	66	61	7	10	2	246	181	164
Interim Licences Issued	5	73	2	55	7	14	0	3	159	192	99
Interim Licences Re-issued	1	53	0	4	6	4	0	1	69	109	86
Temporary Permits Issued	3	0	0	0	43	0	15	0	61	34	62
Temporary Permits Re-issued	0	0	0	0	6	0	1	0	7	7	10
Licences Issued	9	130	2	76	33	37	1	2	290	316	226
Licences Re-issued	0	15	0	3	0	1	0	0	19	22	15
Transfers	1	1	0	4	17	7	1	0	31	18	18
Cancellations	4	35	0	10	33	2	2	0	86	40	50

Note: All data represents number of wells except Exploration Permits.

TABLE 15
Groundwater Rights In Good Standing

	Dom.	Mun.	Irgtn.	Agr.	Ind.	Other	Dvrsn.	Storage	Total 87/88	Total 86/87	Total 85/86
Applications	0	17	0	6	8	0	0	0	31	18	332
Interim Licences	10	79	4	47	31	10	2	2	185	340	484
Licences	103	666	21	750	496	126	20	9	2,191	1,929	1,624
Temporary Permits*	5	2	0	0	297	1	54	0	359	325	—
Net Totals	118	764	25	803	832	137	76	11	2,766	2,612	2,440

* Temporary permits were removed from the application stage into a separate category effective March 30, 1987.

TABLE 16
Summary Regional Services Branch Activities

	Peace River	Edmonton	Red Deer	Calgary	Lethbridge
Inspections					
Requests Received	274	426	305	230	283
Number Conducted	270	450	285	167	315
Water Resources Act					
Licences Issued	26	53	13	3	10
Permits Issued	153	247	143	94	58
Letters of Authority	34	66	15	47	20
Water Management Projects					
Alberta Water Management & Erosion Control Program	16	35	7	8	1
Farm Water Management Program					
Requests Received	64	22	40	1	26
Designs Completed	37	12	19	5	19
Enforcement					
Alleged Violations	24	82	22	16	20
Cases Resolved Regionally	23	78	15	7	2
Cases Reviewed by Enforcement Comm.	1	4	3	1	3
Court Briefs Prepared for Prosecution	1	3	2	0	2

TABLE 17
Summary of Records Administration Section Activities

Fiscal Year	Files Created	Reports Indexed	Files Retrieved	Plans Filmed	35mm Images Produced	16mm Images Produced	Micro-Jackets Produced	Duplicated File Produced
1985-86	818	445	42,654	3,249	6,875	212,225	5,746	53,188
1986-87	648	335	48,118	4,666	7,962	328,355	12,403	63,980
1987-88	570	546	27,500	5,043	8,321	421,265	21,588	36,322

Records Disposition
1985-86 -67 cubic feet
1986-87 - 125 1/4 cubic feet
1987-88 -63 cubic feet

Table 18
Reclamation Projects

Disturbance	Municipal	Public	Green area	Total
Garbage Dumps/Landfill	54	1	2	57
Sewage Lagoons	18	-	-	18
Gravel and Sand Pits	8	4	-	12
Coal Mines	1	-	-	1
Industrial Sites	-	-	2	2
Water Reservoirs	2	-	-	2
Miscellaneous	1	1	2	4
Total	84	6	6	96

Table 19
New Project Referrals to EIA Review Branch

Type of Projects	Number of Referrals
Coal	1
Oil and Gas	17
Industrial	14
Hydro/Electric	4
Linear	4
Oil Sands	26
Recreation	5
Water Resources	3
Other	7
Total	81

TABLE 20
Ministerial Consents Summary

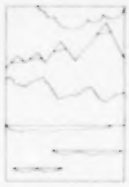
RDA	Total Requests	Consent	No Consent Required	*P/W/A	Total 1974-88
Blue Ridge	0	0	0	0	8
Calgary	96	90	0	6	1251
Capital City Park	6	3	1	2	66
Edmonton	58	58	0	0	608
Edmonton-Devon	12	12	0	0	203
Edmonton-Fort Saskatchewan	8	8	0	0	145
Fish Creek	0	0	0	0	14
Fort McMurray	3	3	0	0	63
Sherwood Park West	6	4	0	2	118
Strathcona	0	0	0	0	8
Turtle Mountain	0	0	0	0	11
Total	189	178	1	10	2495

* Pending/Withdrawn/Administative Closure

TABLE 21
Subdivision Referral Activities

Planning Authority	No. of Applications 1986/87	1987/88
Regional Planning Commissions		
Battle River	70	60
Calgary	147	160
Edmonton Metropolitan	65	70
Mackenzie	40	42
Oldman River	94	80
Palliser	130	103
South Peace	45	20
Red Deer	216	192
Southeast Alberta	21	17
Yellowhead	139	124
Planning Services Division (Municipal Affairs)	147	144
Cities		
Airdrie	4	2
Camrose	6	9
Leduc	3	2
Lethbridge	0	4
Fort McMurray	0	2
St. Albert	6	9
Fort Saskatchewan	0	0
Counties		
Grande Prairie No. 1	45	26
Parkland No. 31	34	33
Strathcona No. 20	27	54
Municipal District of		
Rocky View No. 44	180	226
Total	1,419	1,379

FINANCIAL STATEMENTS



STATEMENT OF EXPENDITURES
FOR THE YEAR ENDED MARCH 31, 1988

VOTE	GENERAL REVENUE FUND		
1.	**Department Support Services**		
	Minister's Office	$ 205,885	
	Deputy Minister's Office	504,012	
	Finance & Office Services	1,980,714	
	Systems & Computing	1,484,658	
	Policy Planning & Information Services	1,020,764	
	Personnel & Organization Development	565,723	
	Total		$ 5,761,756
2.	**Pollution Prevention and Control**		
	Program Support	1,228,758	
	Air Quality Management	2,645,751	
	Water Quality Management	2,136,987	
	Municipal Water and Sewage Management	1,622,302	
	Earth Contamination	2,434,402	
	Waste Management	4,693,017	
	Chemical and Pesticide Management	1,693,259	
	Total		$ 16,454,476
3.	**Land Conservation**		
	Program Support	59,134	
	Land Conservation and Reclamation	3,026,999	
	Environmental Assessment	1,925,318	
	Total		$ 5,011,451
4.	**Water Resources Management Services**		
	Program Support	174,700	
	Surface Water Development & Control	11,758,310	
	Water Resources Administration	10,361,090	
	Operation and Maintenance	7,729,289	
	Data Collection Inventory	6,321,941	
	Water Resources Planning & Co-ordination	4,424,872	
	Groundwater Development	1,624,353	
	Total		$ 42,394,555
5.	**Environmental Research**		$ 2,600,694
6.	**Interdisciplinary Environmental Research & Services**		
	Program Support	2,294,414	
	Plant Sciences	1,640,476	
	Chemistry	2,444,717	
	Animal Sciences	2,105,272	
	Environmental Technology	1,833,081	
	Total		$ 10,317,960
	TOTAL GENERAL REVENUE FUND EXPENDITURES		**$ 82,540,892**
	Capital Fund – Construction of Water Development Projects		$ 27,264,247
	Heritage Savings Trust Fund		
	Irrigation Headworks Improvement	45,612,366	
	Land Reclamation	2,014,387	
	Total Heritage Savings Trust Fund Expenditures		$ 47,626,753
	TOTAL EXPENDITURES		**$157,431,892**

STATEMENT OF REVENUES
FOR THE YEAR ENDED MARCH 31, 1988

SOURCES OF REVENUE

Water Diversion Permits	$ 7,818
Water Well Drilling Permits	8,433
Water Power Rentals	276,450
Department Miscellaneous	34,596
Previous Year Refunds	77,960
Industrial Water Diversion	88,167
McLennan-Girouxville Canal	4,317
North West Alberta Cost Sharing Program	5,581
Groundwater Data	7, 105
Land Leases	4,000
Sheerness Deadfish Creek	49,285
Forfeits - Plans and Specifications	6,825
Land and Grazing	5,680
Alberta Environment Centre - Research	22,700
Emergency Water Pumping	142,296
TOTAL REVENUE	**$ 741,213**

WATER RESOURCES REVOLVING FUND FINANCIAL STATEMENTS

MARCH 31, 1988

ALBERTA LEGISLATURE

OFFICE OF THE AUDITOR GENERAL
AUDITOR'S REPORT

To the Minister of Environment,

I have examined the balance sheet of the Water Resources Revolving Fund as at March 31, 1988 and the statement of operations and deficit for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Fund as at March 31, 1988 and the results of its operations and the changes in its financial position for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Donald D. Salmon

C.A.

Auditor General

Edmonton, Alberta

July 6, 1988

WATER RESOURCES REVOLVING FUND BALANCE SHEET
AS AT MARCH 31, 1988

Assets	1988	1987
Current:		
Accounts Receivable	$ 347,957	$ 379,617
Materials	227,465	258.092
Prepaid expenses	3,219	2,149
	578,641	639,858
Other:		
Rental Equipment (Note 3)	2,742,252	2,917,335
Maintenance and office equipment (Note 4)	24,441	55,451
	$ 3,345,334	**$ 3,612,644**
Liabilities and Deficit		
Accounts Payable	$ 244,333	$ 161,257
Advances from the General Revenue Fund	3,220,418	3,514,140
	3,464,751	3,675,397
Deficit	(119,417)	(62,7453)
	$ 3,345,334	**$ 3,612,644**

The Accompanying notes are part of these financial statements.

WATER RESOURCES REVOLVING FUND STATEMENT OF OPERATIONS AND DEFICIT

FOR THE YEAR ENDED MARCH 31, 1988

	1988	1987
Revenue:		
Material and gas sales	$ 164,781	$ 425,307
Less: Cost of goods sold	156,258	411,782
Gross profit on sales	8,523	13,525
Equipment rental	1,867,466	1,930,786
	1,875,989	1,944,311
Expenses:		
Operation of equipment	1,170,349	1,096,207
Depreciation	514,131	519,930
Equipment rental	247,623	320,896
Repair and maintenance operations	45,610	45,127
Administration (Note 5)	31,363	27,639
	2,009,076	2,009,799
Operating loss	(133,087)	(65,488)
Gain on disposal of equipment	76,423	36,698
Deficit for the year	(56,664)	(28,790)
Deficit at beginning of year	(62,753)	(33,963)
Deficit at end of year	**$ (119,417)**	**$ (62,753)**

WATER RESOURCES REVOLVING FUND NOTES TO THE FINANCIAL STATEMENTS
MARCH 31, 1988

Note 1 Authority

The Water Resources Revolving Fund operates under the authority of the Water Resources Act, Chapter W-5, Revised Statutes of Alberta 1980, as amended.

Note 2 Significant Accounting Policies and Reporting Practices

(a) Depreciation
Depreciation is calculated on a straight-line basis over the estimated useful life of each type of equipment.

(b) Major overhauls
Major overhauls, significantly extending the life of equipment, are depreciated on a straight-line basis over the remaining useful life of the equipment.

(c) Materials inventory
Materials are valued at weighted average cost.

(d) Leases
All leases with respect to the rental and maintenance of equipment, as lessee or lessor, can be cancelled at the end of any fiscal year and are therefore accounted for as operating leases.

(e) Changes in financial position
A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 3 Rental Equipment

	1988	1987
Cost	$ 6,455,968	$ 6,355,539
Accumulated depreciation	3,713,716	3,438,204
	$ 2,742,252	$ 2,917,335

Note 4 Maintenance and Office Equipment

	1988	1987
Cost	$ 231,723	$ 231,927
Acculmulated depreciation	207,282	176,476
	$ 24,441	$ 55,451

Note 5 Administration Expenses

Salaries, wages, rental charges for the Edmonton, Lethbridge, Grande Prairie and Peace River warehouses and certain overhead cost incurred in the administration of the Fund are borne by the General Revenue Fund and are not reflected in these financial statements.

Note 6 Approval of Financial Statements

These financial statements were approved by management.

SURFACE RECLAMATION FUND FINANCIAL STATEMENT

MARCH 31, 1988

ALBERTA LEGISLATURE

OFFICE OF THE AUDITOR GENERAL
AUDITOR'S REPORT

To the Members of the Land Conservation
and Reclamation Council

I have examined the balance sheet of the Surface Reclamation Fund as at March 31, 1988. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, this financial statement presents fairly the financial position of the Fund as at March 31, 1988 in accordance with generally accepted accounting principles applies on a basis consistent with that of the preceding year.

Donald D. Salmon

C.A.
Auditor General

Edmonton, Alberta
July 19, 1988

SURFACE RECLAMATION FUND BALANCE SHEET
AS AT MARCH 31, 1988

	1988	1987
Assets		
Cash (Note 2)	$ 1,385,629	$ 1,322,654
Securities in trust with the Province of Alberta	332,925	218,425
	$ 1,718,554	**$ 1,541,079**
Liabilities		
Trust Fund (Note 3)	**$ 1,718,554**	**$ 1,541,079**

The accompanying notes are part of this financial statement.

SURFACE RECLAMATION FUND NOTES TO THE FINANCIAL STATEMENT
MARCH 31, 1988

Note 1 Authority

The Surface Reclamation Fund operates under the authority of the Land Surface Conservation and Reclamation Act, Chapter L-3, Revised Statues of Alberta 1980, as amended. The purpose of the Fund is to hold security deposits received pursuant to the Act as an assurance that satisfactory land surface reclamation will be performed. Since all interest received by the Fund is allocated and subsequently paid to depositors, no surplus or deficit arises on the Fund's operations.

Note 2 Cash

Cash consists of deposits in the Consolidated Cash Investment Trust Fund of the Province of Alberta.

Note 3 Trust Fund

Transactions in the Trust Fund are summarized as follows:

	Cash Deposits	Securities	1988 Total	1987 Total
Balance at beginning of year	$ 1,322,654	$ 218,425	$ 1,541,079	$ 1,624,383
Security deposits received	474,290	189,500	663,790	342,122
Interest received	116,054	—	116,054	115,243
	1,912,998	407,925	2,320,923	2,081,748
Security deposits returned	527,369	75,000	602,369	540,669
Balance at end of year	**$ 1,385,629**	**$ 332,925**	**$ 1,718,554**	**$ 1,541,079**

Note 4 Bank Guarantees

In addition to the deposits in trust and securities shown on the balance sheet, the Fund held bank guarantees as at March 31, 1988 in the amount of $80,574,694 (1987 $61,939,809).

Note 5 Approval of Financial Statement

This financial statement was approved by management.